

**NATIONAL**  
Boilers  
Radiators and  
Specialties





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# **NATIONAL**

Boilers, Radiators, Specialties

*Catalog No. 26*

**NATIONAL RADIATOR COMPANY**  
GROWN FROM A SMALL FOUNDRY IN 1894— BECAUSE THE CUSTOMER SO DICTATED  
General Offices Johnstown, Pa.

Prices published in this edition supersede all former lists and are subject to change without notice. Discounts are quoted to regular trade only.

**N**ATIONAL heating materials are built to meet every requirement of the fitter and property owner by men, who because of long experience, understand heating problems thoroughly. Having operated continuously since 1894, the National Radiator Company has been called upon time and again to increase its manufacturing facilities in order to supply the constantly increasing demand for its products. In presenting this edition of our handbook to friends and patrons, we call attention to the completeness and high quality of our line. Whether it be a small cottage or a large public building, we are prepared to furnish suitable materials for warming the building by any approved method of steam or hot water heating.

NATIONAL RADIATOR COMPANY  
Johnstown, Pa.

#### BRANCHES

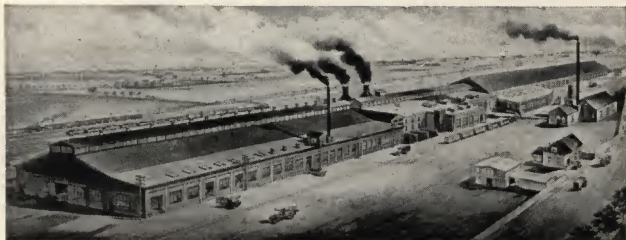
New York.....	1358 Broadway.
Philadelphia.....	1325 Arch Street.
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# Plants in Which National Heating Materials Are Made



JOHNSTOWN, PA., PLANT



TRENTON, N. J., PLANT



NEW CASTLE, PA., PLANT

THIS CATALOG NO. 26  
PLANNED AND PREPARED BY THE  
ADVERTISING DEPT. OF THE NATIONAL RADIATOR COMPANY  
FEBRUARY, 1920

# NATIONAL NOVUS BOILERS



## MEASUREMENTS, RATINGS AND LIST PRICES—(Dimensions in Inches)

No. Steam	Eight Hour Ratings	List Price Complete	Height to Top Outlet	Ex-treme Depth Boiler	Size Base	Grate Area Sq. Ft.	2 Out-lets 2 In-lets Size	Height Water Line	Height Top Smoke Hood	Size Smoke Pipe
No. 0 Series—Base, Three-piece Firepot (with Crown Sheet) and Dome										
20-S	380	\$126.50	41	30	24x24	1.69	2	36 $\frac{1}{8}$	48 $\frac{1}{2}$	7
30-S	535	150.00	53	31 $\frac{1}{2}$	30x25	2.34	3	46 $\frac{1}{8}$	61	9
40-S	700	175.00	53	36 $\frac{1}{2}$	30x30	2.98	3	47 $\frac{1}{8}$	61	9
50-S	940	226.00	54 $\frac{1}{2}$	38 $\frac{1}{2}$	36x30	4.16	4	48 $\frac{1}{4}$	62 $\frac{1}{2}$	10
60-S	1175	276.50	54 $\frac{1}{2}$	44	36x36	5.05	4	48 $\frac{3}{8}$	62 $\frac{1}{2}$	10
No. 1 Series—Base, Three-piece Firepot (with Crown Sheet) Center Section and Dome										
21-S	400	142.00	45 $\frac{1}{2}$	30	24x24	1.69	2	41 $\frac{1}{4}$	53	7
31-S	570	168.50	57 $\frac{1}{2}$	31 $\frac{1}{2}$	30x25	2.34	3	51 $\frac{1}{8}$	65 $\frac{1}{2}$	9
41-S	750	196.50	57 $\frac{1}{2}$	36 $\frac{1}{2}$	30x30	2.98	3	51 $\frac{1}{4}$	65 $\frac{1}{2}$	9
51-S	1000	254.00	59 $\frac{1}{2}$	38 $\frac{1}{2}$	36x30	4.16	4	53 $\frac{1}{4}$	67 $\frac{1}{2}$	10
61-S	1250	311.50	59 $\frac{1}{2}$	44	36x36	5.05	4	53 $\frac{3}{8}$	67 $\frac{1}{2}$	10
No. 2 Series—Base, Three-piece Firepot (with Crown Sheet), two Center Sections and Dome										
22-S	430	157.00	50	30	24x24	1.69	2	45 $\frac{5}{8}$	57 $\frac{1}{2}$	7
32-S	600	185.50	62	31 $\frac{1}{2}$	30x25	2.34	3	55 $\frac{3}{4}$	70	9
42-S	800	219.50	62	36 $\frac{1}{2}$	30x30	2.98	3	56 $\frac{1}{8}$	70	9
52-S	1050	280.00	64 $\frac{1}{2}$	38 $\frac{1}{2}$	36x30	4.16	4	58 $\frac{1}{8}$	72 $\frac{1}{2}$	10
62-S	1325	346.50	64 $\frac{1}{2}$	44	36x36	5.05	4	58	72 $\frac{1}{2}$	10

For additional measurements, see pages 6 and 7.

Arranged for pipe coil for heating water for domestic purposes.

Do not bush flow outlets on steam boilers. Connect full size to main where velocity of steam exceeds 20 feet per second under maximum conditions of load.

Covering, see page 104.

List price repairs, page 94.

# NATIONAL NOVUS BOILERS



THREE  
PIECE  
FIREPOT

Patented

## MEASUREMENTS, RATINGS AND LIST PRICES (Dimensions in Inches)

No. Water	Eight Hour Ratings	List Price Complete	Height to Top Outlet	Ex-treme Depth Boiler	Size Base	Grate Area Sq. Ft.	2 Out-lets 2 Inlets Size	Height Top Smoke Hood	Size Smoke Pipe
No. 0 Series—Base, Three-piece Firepot (with Crown Sheet) and Dome									
20-W	625	\$ 96.00	38½	30	24x24	1.69	2	45½	7
30-W	880	116.50	46½	31½	30x25	2.34	3	54	9
40-W	1155	138.50	46½	36½	30x30	2.98	3	54	9
50-W	1550	183.00	48	38½	36x30	4.16	4	56	10
60-W	1940	227.50	48	44	36x36	5.05	4	56	10
No. 1 Series—Base, Three-piece Firepot (with Crown Sheet), Center Section and Dome									
21-W	660	111.00	43	30	24x24	1.69	2	50	7
31-W	940	136.00	51	31½	30x25	2.34	3	58½	9
41-W	1240	162.50	51	36½	30x30	2.98	3	58½	9
51-W	1650	213.50	53	38½	36x30	4.16	4	61	10
61-W	2065	265.50	53	44	36x36	5.05	4	61	10
No. 2 Series—Base, Three-piece Firepot, (with Crown Sheet) two Center Sections and Dome									
22-W	710	123.50	47½	30	24x24	1.69	2	54½	7
32-W	990	150.50	55½	31½	30x25	2.34	3	63	9
42-W	1320	182.00	55½	36½	30x30	2.98	3	63	9
52-W	1735	238.00	58	38½	36x30	4.16	4	66	10
62-W	2185	298.50	58	44	36x36	5.05	4	66	10

For additional measurements, see pages 6 and 7.

Arranged for pipe coil for heating water for domestic purposes.

Covering, see page 104.

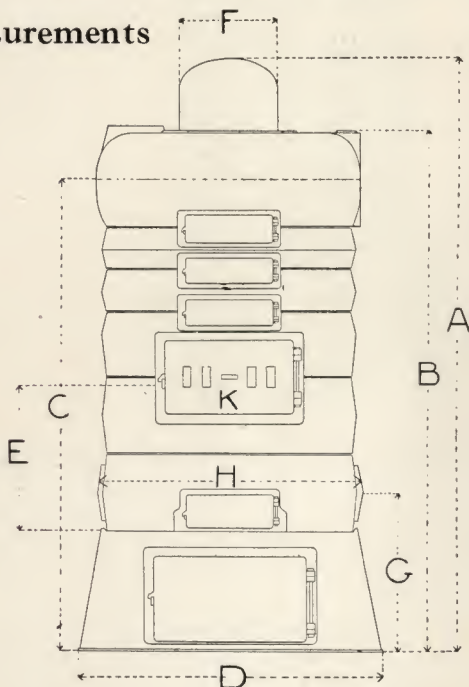
List price repairs, page 94.

# NATIONAL NOVUS BOILERS

ON the opposite page there is a table giving all measurements applying to this illustration. Outline does not represent water boiler. The outline of the steam boiler is used to show the measurements of both the steam and water types.

For convenience in ordering repairs for firepot, we have numbered each section from the bottom and up.

## Measurements



## Center to Center Outlet Opening Measurements

30-40 Series		50 Series		60 Series	
W	S	W	S	W	S
16 1/4 Inches	16 1/4 Inches	21 1/4 Inches	22 Inches	21 Inches	22 Inches



# NATIONAL NOVUS BOILERS

The following table gives all the measurements in inches on National Novus Steam and Hot-Water Boilers, upright types.

## STEAM

Size	A	B	C	D	E	F	G	H	K
30-S	61	53	44 1/2	30	17 1/2	10	18 7/8	25	12 x8
31-S	65 1/2	57 1/2	49	30	17 1/2	10	18 7/8	25	12 x8
32-S	70	62	53 1/2	30	17 1/2	10	18 7/8	25	12 x8
40-S	61	53	44 1/2	30	17 1/2	10	18 7/8	25	12 x8
41-S	65 1/2	57 1/2	49	30	17 1/2	10	18 7/8	25	12 x8
42-S	70	62	53 1/2	30	17 1/2	10	18 7/8	25	12 x8
50-S	62 1/2	54 1/2	45 1/2	36 1/2	18 1/8	11 3/4	19	32	14 1/2 x8 1/4
51-S	67 1/2	59 1/2	50 1/2	36 1/2	18 1/8	11 3/4	19	32	14 1/2 x8 1/4
52-S	72 1/2	64 1/2	55 1/2	36 1/2	18 1/8	11 3/4	19	32	14 1/2 x8 1/4
60-S	62 1/2	54 1/2	45 1/2	36 1/2	18 1/8	11 3/4	19	32	14 1/2 x8 1/4
61-S	67 1/2	59 1/2	50 1/2	36 1/2	18 1/8	11 3/4	19	32	14 1/2 x8 1/4
62-S	72 1/2	64 1/2	55 1/2	36 1/2	18 1/8	11 3/4	19	32	14 1/2 x8 1/4

## WATER

Size	A	B	C	D	E	F	G	H	K
30-W	54	46 1/2	....	30	17 1/2	10	18 7/8	25	12 x8
31-W	58 1/2	51	....	30	17 1/2	10	18 7/8	25	12 x8
32-W	63	55 1/2	....	30	17 1/2	10	18 7/8	25	12 x8
40-W	54	46 1/2	....	30	17 1/2	10	18 7/8	25	12 x8
41-W	58 1/2	51	....	30	17 1/2	10	18 7/8	25	12 x8
42-W	63	55 1/2	....	30	17 1/2	10	18 7/8	25	12 x8
50-W	56	48	....	36 1/2	18 1/8	11 3/4	19	32	14 1/2 x8 1/4
51-W	61	53	....	36 1/2	18 1/8	11 3/4	19	32	14 1/2 x8 1/4
52-W	66	58	....	36 1/2	18 1/8	11 3/4	19	32	14 1/2 x8 1/4
60-W	56	48	....	36 1/2	18 1/8	11 3/4	19	32	14 1/2 x8 1/4
61-W	61	53	....	36 1/2	18 1/8	11 3/4	19	32	14 1/2 x8 1/4
62-W	66	58	....	36 1/2	18 1/8	11 3/4	19	32	14 1/2 x8 1/4

## ADDITIONAL MEASUREMENTS

Series of Boiler (Upright)	Actual Size of Grate Inches	Depth of Ash Pit Under Grate Inches	Size of Ash Base Inches	Height of Ash Base Inches	Size of Fire Door Opening Inches	Width of Boiler Inches	Ex-treme Length of Boiler Inches
30	15 5/8 x 19 3/8	11	25 x 30	14 1/2	8 x 12	25	31 1/2
40	19 1/2 x 20 3/8	11	30 x 30	14 1/2	8 x 12	25	36 1/2
50	25 3/4 x 21	10 1/2	30 1/2 x 36 1/2	14 1/2	8 1/4 x 14 1/2	32	38 1/2
60	26 1/8 x 26 1/4	10 1/2	36 1/2 x 35 1/2	14 1/2	8 1/4 x 14 1/2	32	44

Note: On steam boiler add 4 inches to width of boiler for steam trimmings.

# NATIONAL NICO BOILERS



No. S-22-2

## Nico Steam Boilers

No. of Boiler	Height to Top of Outlets, Ins.	Height of Water Line, Inches	Outside Diam. Base, Inches	Nominal Diam. of Firepot	No. and Size of Outlets, Ins.	No. and Size of Inlets, Inches	Size of Smoke Pipe, Inches	Rating	Price Complete
S-17-2	49 $\frac{1}{8}$	43 $\frac{5}{8}$	24	17	2-2 $\frac{1}{2}$	2-2 $\frac{1}{2}$	7	275	\$140.50
S-17-3	53 $\frac{5}{8}$	48 $\frac{1}{8}$	24	17	2-2 $\frac{1}{2}$	2-2 $\frac{1}{2}$	7	300	149.50
S-17-4	58 $\frac{1}{8}$	52 $\frac{5}{8}$	24	17	2-2 $\frac{1}{2}$	2-2 $\frac{1}{2}$	7	325	163.50
S-19-2	50 $\frac{1}{8}$	44 $\frac{1}{2}$	26	19	2-2 $\frac{1}{2}$	2-2 $\frac{1}{2}$	8	350	167.00
S-19-3	54 $\frac{5}{8}$	49	26	19	2-2 $\frac{1}{2}$	2-2 $\frac{1}{2}$	8	400	193.00
S-19-4	59 $\frac{1}{8}$	53 $\frac{1}{2}$	26	19	2-2 $\frac{1}{2}$	2-2 $\frac{1}{2}$	8	450	206.50
S-22-2	50 $\frac{3}{4}$	45 $\frac{1}{4}$	29	22	2-3	2-3	9	450	206.50
S-22-3	55 $\frac{1}{4}$	49 $\frac{3}{4}$	29	22	2-3	2-3	9	525	226.00
S-22-4	59 $\frac{3}{4}$	54 $\frac{1}{4}$	29	22	2-3	2-3	9	575	240.00
S-25-2	52 $\frac{1}{4}$	45 $\frac{3}{4}$	32	25	2-3	2-4	10	600	252.50
S-25-3	57	50 $\frac{1}{2}$	32	25	2-3	2-4	10	700	300.00
S-25-4	61 $\frac{3}{4}$	55 $\frac{1}{4}$	32	25	2-3	2-4	10	775	322.50
2820	60 $\frac{1}{2}$	51 $\frac{1}{2}$	41	28	2-5	2-5	12	950	375.00
2830	65 $\frac{3}{4}$	56 $\frac{3}{4}$	41	28	2-5	2-5	12	1050	405.00
2840	71	62	41	28	2-5	2-5	12	1150	440.00

Do not bush flow outlets on steam boilers. Connect full size to main where velocity of steam exceeds 20 feet per second under maximum condition of load.

Arranged for pipe coil for heating water for domestic purposes.

Covering, see page 104. For additional measurements, see pages 10 and 11.

List price repairs, see page 95.

# NATIONAL NICO BOILERS



No. W-22-2

## Nico Water Boilers

No. of Boiler	Height to Top of Outlet, Ins.	Outside Diam. of Base, Inches	Nominal Diam. of Firepot	No. and Size Outlets, Inches	No. and Size Inlets, Inches	Size of Smoke Pipe, Inches	Rating	Price Complete
W-17-2	45 $\frac{1}{8}$	24	17	2-2 $\frac{1}{2}$	2-2 $\frac{1}{2}$	7	450	\$131.50
W-17-3	49 $\frac{3}{8}$	24	17	2-2 $\frac{1}{2}$	2-2 $\frac{1}{2}$	7	500	140.50
W-17-4	54 $\frac{1}{8}$	24	17	2-2 $\frac{1}{2}$	2-2 $\frac{1}{2}$	7	550	153.50
W-19-2	46 $\frac{1}{8}$	26	19	2-2 $\frac{1}{2}$	2-2 $\frac{1}{2}$	8	575	158.00
W-19-3	50 $\frac{3}{8}$	26	19	2-2 $\frac{1}{2}$	2-2 $\frac{1}{2}$	8	650	184.50
W-19-4	55 $\frac{1}{8}$	26	19	2-2 $\frac{1}{2}$	2-2 $\frac{1}{2}$	8	725	195.00
W-22-2	46 $\frac{3}{4}$	29	22	2-3	2-3	9	750	197.00
W-22-3	51 $\frac{1}{4}$	29	22	2-3	2-3	9	875	217.50
W-22-4	55 $\frac{3}{4}$	29	22	2-3	2-3	9	950	230.00
W-25-2	49	32	25	2-4	2-4	10	975	240.00
W-25-3	53 $\frac{3}{4}$	32	25	2-4	2-4	10	1125	285.00
W-25-4	58 $\frac{1}{2}$	32	25	2-4	2-4	10	1250	310.00
282	52 $\frac{3}{4}$	41	28	2-5	2-5	12	1450	341.50
283	58	41	28	2-5	2-5	12	1600	370.00
284	63 $\frac{1}{4}$	44	28	2-5	2-5	12	1750	395.00

Arranged for pipe coil for heating water for domestic purposes.

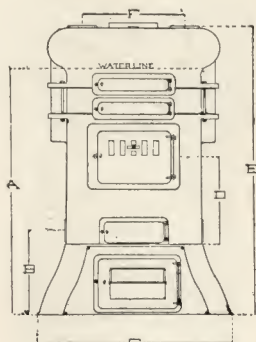
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# NATIONAL NICO BOILERS

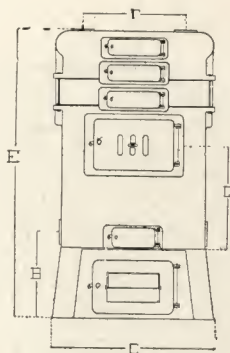


## Nico Boiler Measurements

Steam — Measurements are in inches.

Nico	A	B	C	D	E	F	Size of Fire Door
S-17-2	43 $\frac{5}{8}$	14 $\frac{3}{4}$	24	16	49 $\frac{1}{8}$	12	8 $\frac{1}{2}$ x12
S-17-3	48 $\frac{1}{8}$	14 $\frac{3}{4}$	24	16	53 $\frac{5}{8}$	12	8 $\frac{1}{2}$ x12
S-17-4	52 $\frac{5}{8}$	14 $\frac{3}{4}$	24	16	58 $\frac{1}{8}$	12	8 $\frac{1}{2}$ x12
S-19-2	44 $\frac{1}{2}$	14 $\frac{3}{4}$	26	17 $\frac{1}{4}$	50 $\frac{1}{8}$	14 $\frac{1}{4}$	8 $\frac{1}{2}$ x12
S-19-3	49	14 $\frac{3}{4}$	26	17 $\frac{1}{4}$	54 $\frac{5}{8}$	14 $\frac{1}{4}$	8 $\frac{1}{2}$ x12
S-19-4	53 $\frac{1}{2}$	14 $\frac{3}{4}$	20	17 $\frac{1}{4}$	59 $\frac{1}{8}$	14 $\frac{1}{4}$	8 $\frac{1}{2}$ x12
S-22-2	45 $\frac{1}{4}$	15 $\frac{1}{4}$	29	17 $\frac{3}{4}$	50 $\frac{3}{4}$	16	8 $\frac{1}{2}$ x14
S-22-3	49 $\frac{3}{4}$	15 $\frac{1}{4}$	29	17 $\frac{3}{4}$	55 $\frac{1}{4}$	16	8 $\frac{1}{2}$ x14
S-22-4	54 $\frac{1}{4}$	15 $\frac{1}{4}$	29	17 $\frac{3}{4}$	59 $\frac{3}{4}$	16	8 $\frac{1}{2}$ x14
S-25-2	45 $\frac{3}{4}$	15 $\frac{3}{4}$	32	18 $\frac{1}{4}$	52 $\frac{1}{4}$	17 $\frac{1}{2}$	8 $\frac{1}{2}$ x14
S-25-3	50 $\frac{1}{2}$	15 $\frac{3}{4}$	32	18 $\frac{1}{4}$	57	17 $\frac{1}{2}$	8 $\frac{1}{2}$ x14
S-25-4	55 $\frac{1}{4}$	15 $\frac{3}{4}$	32	18 $\frac{1}{4}$	61 $\frac{3}{4}$	17 $\frac{1}{2}$	8 $\frac{1}{2}$ x14
2820	51 $\frac{1}{2}$	19 $\frac{1}{4}$	41	17 $\frac{5}{8}$	60 $\frac{1}{2}$	24 $\frac{1}{8}$	8 $\frac{1}{2}$ x15 $\frac{1}{2}$
2830	56 $\frac{3}{4}$	19 $\frac{1}{4}$	41	17 $\frac{5}{8}$	65 $\frac{3}{4}$	24 $\frac{1}{8}$	8 $\frac{1}{2}$ x15 $\frac{1}{2}$
2840	62	19 $\frac{1}{4}$	41	17 $\frac{5}{8}$	71	24 $\frac{1}{8}$	8 $\frac{1}{2}$ x15 $\frac{1}{2}$

# NATIONAL NICO BOILERS



## Nico Boiler Measurements

Water — Measurements are in inches.

Nico	B	C	D	E	F	Size of Fire Door
W-17-2	14 <sup>3</sup> / <sub>4</sub>	24	16	45 <sup>1</sup> / <sub>8</sub>	12 <sup>3</sup> / <sub>4</sub>	8 <sup>1</sup> / <sub>2</sub> x12
W-17-3	14 <sup>3</sup> / <sub>4</sub>	24	16	49 <sup>5</sup> / <sub>8</sub>	12 <sup>3</sup> / <sub>4</sub>	8 <sup>1</sup> / <sub>2</sub> x12
W-17-4	14 <sup>3</sup> / <sub>4</sub>	24	16	54 <sup>1</sup> / <sub>8</sub>	12 <sup>3</sup> / <sub>4</sub>	8 <sup>1</sup> / <sub>2</sub> x12
W-19-2	14 <sup>3</sup> / <sub>4</sub>	26	17 <sup>1</sup> / <sub>4</sub>	46 <sup>1</sup> / <sub>8</sub>	13 <sup>3</sup> / <sub>8</sub>	8 <sup>1</sup> / <sub>2</sub> x12
W-19-3	14 <sup>3</sup> / <sub>4</sub>	26	17 <sup>1</sup> / <sub>4</sub>	50 <sup>5</sup> / <sub>8</sub>	13 <sup>3</sup> / <sub>8</sub>	8 <sup>1</sup> / <sub>2</sub> x12
W-19-4	14 <sup>3</sup> / <sub>4</sub>	26	17 <sup>1</sup> / <sub>4</sub>	55 <sup>1</sup> / <sub>8</sub>	13 <sup>3</sup> / <sub>8</sub>	8 <sup>1</sup> / <sub>2</sub> x12
W-22-2	15 <sup>1</sup> / <sub>16</sub>	29	17 <sup>3</sup> / <sub>4</sub>	46 <sup>3</sup> / <sub>4</sub>	16	8 <sup>1</sup> / <sub>2</sub> x14
W-22-3	15 <sup>1</sup> / <sub>16</sub>	29	17 <sup>3</sup> / <sub>4</sub>	51 <sup>1</sup> / <sub>4</sub>	16	8 <sup>1</sup> / <sub>2</sub> x14
W-22-4	15 <sup>1</sup> / <sub>16</sub>	29	17 <sup>3</sup> / <sub>4</sub>	55 <sup>3</sup> / <sub>4</sub>	16	8 <sup>1</sup> / <sub>2</sub> x14
W-25-2	15 <sup>3</sup> / <sub>16</sub>	32	18 <sup>1</sup> / <sub>4</sub>	49	18 <sup>1</sup> / <sub>4</sub>	8 <sup>1</sup> / <sub>2</sub> x14
W-25-3	15 <sup>3</sup> / <sub>16</sub>	32	18 <sup>1</sup> / <sub>4</sub>	53 <sup>3</sup> / <sub>4</sub>	18 <sup>1</sup> / <sub>4</sub>	8 <sup>1</sup> / <sub>2</sub> x14
W-25-4	15 <sup>3</sup> / <sub>16</sub>	32	18 <sup>1</sup> / <sub>4</sub>	58 <sup>1</sup> / <sub>2</sub>	18 <sup>1</sup> / <sub>4</sub>	8 <sup>1</sup> / <sub>2</sub> x14
282	19 <sup>1</sup> / <sub>4</sub>	41	17 <sup>5</sup> / <sub>8</sub>	52 <sup>3</sup> / <sub>4</sub>	33	8 <sup>1</sup> / <sub>2</sub> x15 <sup>1</sup> / <sub>2</sub>
283	19 <sup>1</sup> / <sub>4</sub>	41	17 <sup>5</sup> / <sub>8</sub>	58	33	8 <sup>1</sup> / <sub>2</sub> x15 <sup>1</sup> / <sub>2</sub>
284	19 <sup>1</sup> / <sub>4</sub>	41	17 <sup>5</sup> / <sub>8</sub>	63 <sup>1</sup> / <sub>4</sub>	33	8 <sup>1</sup> / <sub>2</sub> x15 <sup>1</sup> / <sub>2</sub>

Discontinued

# NATIONAL NOVUS SECTIONAL BOILERS



No. 20-6-S

## Twenty Series Sectional Steam Boilers

No. of Boiler	Rating See Note	List Price Complete	†Lgth. of Boiler Inches	No. of Secs.	Grate Area Sq. Ft.	Average Firepot Sq. Ft.	Size Foundation Inches	Outlets Inches
20-5-S	650	\$235.00	27 $\frac{3}{4}$	5	3.24	4.15	22 $\frac{1}{2}$ x27 $\frac{3}{4}$	2-3
20-6-S	800	272.00	33 $\frac{1}{2}$	6	4.02	5.18	22 $\frac{1}{2}$ x33 $\frac{1}{2}$	2-3
20-7-S	950	309.00	39 $\frac{1}{4}$	7	4.80	6.22	22 $\frac{1}{2}$ x39 $\frac{1}{4}$	3-3

Height to top of outlet, 54 inches. Width of boiler, 28 inches.

Size smoke pipe, 10 inches. Height of water line, 47 inches.

†Add 12 inches to length to allow for smoke hood.

Do not bush flow outlets on steam boilers. Connect full size to main where velocity of steam exceeds 20 feet per second under maximum conditions of load.

Arranged for pipe coil for heating water for domestic purposes.

Additional measurements, pages 24 and 25.

For price list repairs, see pages 97 and 101.

Assembling chart, see pages 102 and 103.

Covering, see page 104.



No. 6-20-W

## Twenty Series Sectional Water Boilers

No. of Boiler	Rating See Note	List Price Complete	†Lgth. of Boiler Inches	No. of Secs.	Grate Area Sq. Ft.	Average Firepot Sq. Ft.	Size Foundation Inches	Outlets Inches
5-20-W	1100	\$212.00	27 $\frac{3}{4}$	5	3.24	4.15	22 $\frac{1}{2}$ x27 $\frac{3}{4}$	2-3
6-20-W	1370	248.00	33 $\frac{1}{2}$	6	4.02	5.18	22 $\frac{1}{2}$ x33 $\frac{1}{2}$	2-3
7-20-W	1600	284.00	39 $\frac{1}{4}$	7	4.80	6.22	22 $\frac{1}{2}$ x39 $\frac{1}{4}$	3-3

Height to top of outlet, 54 inches. Width of boiler, 28 inches.  
Size of smoke pipe, 10 inches.

†Add 12 inches to length to allow for smoke hood.

Arranged for pipe coil for heating water for domestic purposes.

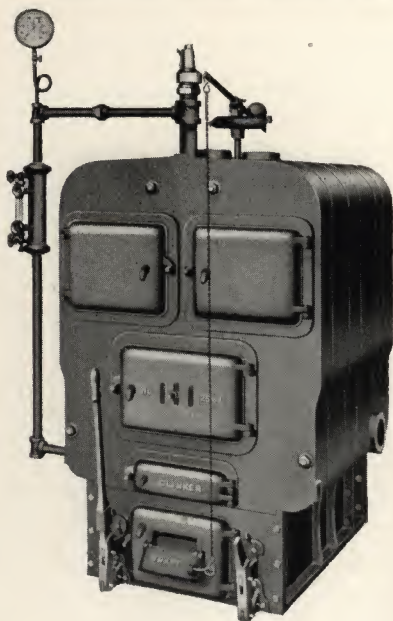
Additional measurements, pages 24 and 25.

For price list repairs, see pages 97 and 101.

Assembling chart, see pages 102 and 103.

Covering, see page 104.

# NATIONAL NOVUS SECTIONAL BOILERS



No. 25-6-S

## Twenty-five Series Sectional Steam Boilers

No. of Boiler	Rating See Note	List Price Complete	*Lgth. of Boiler Inches	No. of Secs.	Grate Area Sq. Ft.	Average Firepot Sq. Ft.	Size Foundation Inches	Outlets Inches
25-5-S	1100	\$346.00	33	5	4.95	6.13	28x33	2-4
25-6-S	1350	407.00	40	6	6.11	7.64	28x40	2-4
25-7-S	1600	469.00	47	7	7.27	9.15	28x47	3-4
25-8-S	1850	517.00	54	8	8.43	10.65	28x54	3-4

Height to top of outlet, 57 $\frac{1}{4}$  inches. Width of boiler, 36 $\frac{1}{2}$  inches.

Size smoke pipe, 12 inches. Height of water line, 49 inches.

\*Add 14 inches to length to allow for smoke hood.

Do not bush flow outlets on steam boilers. Connect full size to mains where velocity of steam exceeds 20 feet per second under maximum conditions of load.

Arranged for pipe coil for heating water for domestic purposes.

Additional measurements, pages 24 and 25.

For price list repairs, see pages 97 and 101.

Assembling chart, see pages 102 and 103.

Covering, see page 104.





No. 6-25-W

## Twenty-five Series Sectional Water Boilers

No. of Boiler	Rating See Note	List Price Complete	†Lgth. of Boiler Inches	No. of Secs.	Grate Area Sq. Ft.	Average Firepot Sq. Ft.	Size Foundation Inches	Outlets Inches
5-25-W	1825	\$316.00	33	5	4.95	6.13	28x33	2-4
6-25-W	2225	374.00	40	6	6.11	7.64	28x40	2-4
7-25-W	2650	435.00	47	7	7.27	9.15	28x47	3-4
8-25-W	3050	477.00	54	8	8.43	10.65	28x54	3-4

Height to top of outlet, 57¼ inches. Width of boiler, 36½ inches.  
Size of smoke pipe, 12 inches.

†Add 14 inches to length to allow for smoke hood.

Arranged for pipe coil for heating water for domestic purposes.

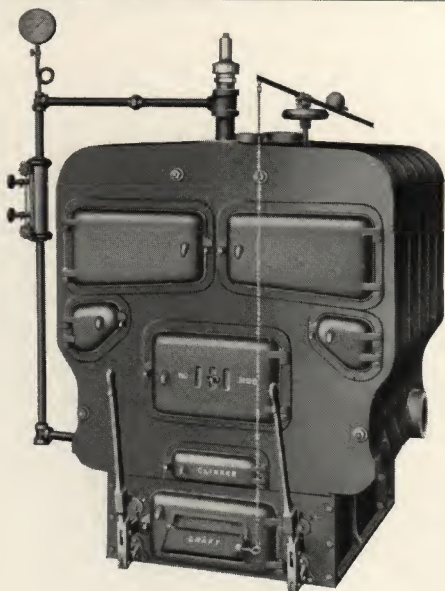
Additional measurements, pages 24 and 25.

For price list repairs, see pages 97 and 101.

Assembling chart, see pages 102 and 103.

Covering, see page 104.

# NATIONAL NOVUS SECTIONAL BOILERS



No. 31-6-S

## Thirty-one Series Sectional Steam Boilers

No. of Boiler	Rating See Note	List Price Complete	*Lgth. of Boiler Inches	No. of Secs.	Grate Area Sq. Ft.	Average Firepot Sq. Ft.	Size Foundation Inches	Outlets Inches
31-6-S	1975	\$541.00	44½	6	8.55	12.62	33½x42½	2-5
31-7-S	2325	607.00	52	7	10.24	15.12	33½x49¾	3-5
31-8-S	2675	674.00	59½	8	11.93	17.62	33½x57¼	3-5
31-9-S	3025	740.00	67	9	13.62	20.11	33½x64¾	3-5

Total height to top of outlet, 61 inches. Total width, 51 inches.

Total height including steam trimmings, 76½ inches.

Total width including steam trimmings, 59¼ inches.

Height of water line, 52 inches. Size of smoke pipe, 15 inches.

\*Add 13 inches to length of boiler for smoke hood.

Do not bush flow outlets on steam boilers. Connect full size to main where velocity of steam exceeds 20 feet per second under maximum conditions of load.

Additional measurements, pages 24 and 25.

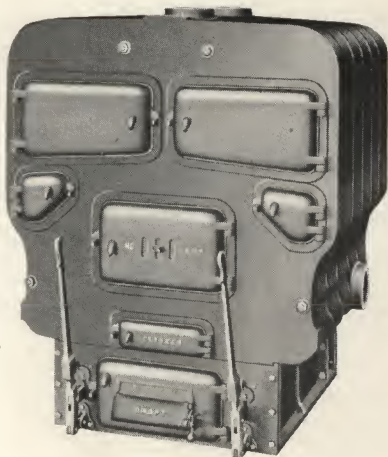
For price list repairs, see pages 97 and 101.

Assembling chart, see pages 102 and 103.

Covering, see page 104.



# NATIONAL NOVUS SECTIONAL BOILERS



No. 6-31-W

## Thirty-one Series Sectional Water Boilers

No. of Boiler	Rating See Note	List Price Complete	*Lgth. of Boiler Inches	No. of Secs.	Grate Area Sq. Ft.	Average Firepot Sq. Ft.	Size Foundation Inches	Outlets Inches
6-31-W	3250	\$499.00	44½	6	8.55	12.62	33½x42½	2-5
7-31-W	3825	559.00	52	7	10.24	15.12	33½x49¾	3-5
8-31-W	4400	620.00	59½	8	11.93	17.62	33½x57¼	3-5
9-31-W	4975	680.00	67	9	13.62	20.11	33½x64¾	3-5

Height to top of outlet, 61 inches. Total width, 51 inches.

Size of smoke pipe, 15 inches.

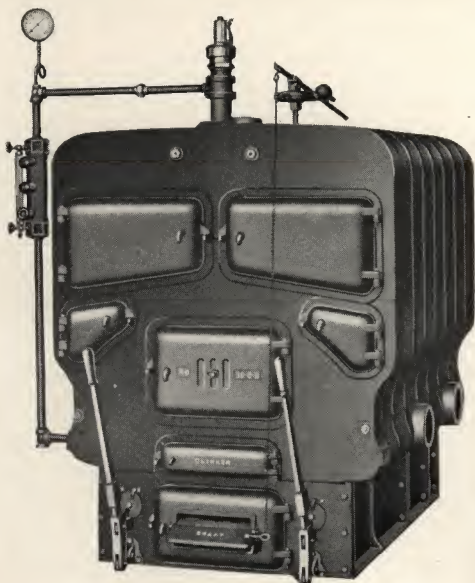
\*Add 13 inches to length of boiler for smoke hood.

Additional measurements, pages 24 and 25.

For price list repairs, see pages 97 and 101.

Assembling chart, see pages 102 and 103.

Covering, see page 104.



No. 36-8-S

## Thirty-six Series Sectional Steam Boilers

No. of Boiler	Rating See Note	List Price Complete	†Lgth. of Boiler Inches	No. of Secs.	Grate Area Sq. Ft.	Average Firepot Sq. Ft.	Size Foundation Inches	Outlets Inches
36- 6-S	2675	\$ 674.00	49	6	11.50	14.69	41½x47½	2-5
36- 7-S	3225	778.00	57½	7	13.75	17.61	41½x56	3-5
36- 8-S	3750	878.00	66	8	16.00	20.54	41½x64½	3-5
36- 9-S	4275	978.00	74½	9	18.25	23.46	41½x73	3-5
36-10-S	4800	1078.00	83	10	20.50	26.38	41½x81	3-5

Height to top of outlet, 70 inches. Width of boiler, 56 inches.

Height of water line, 60¼ inches. Size of smoke pipe, 16 inches.

†Add 14 inches to length to allow for smoke hood.

Do not bush flow outlets on steam boilers. Connect full size to main where velocity of steam exceeds 20 feet per second under maximum conditions of load.

Arranged for pipe coil for heating water for domestic purposes.

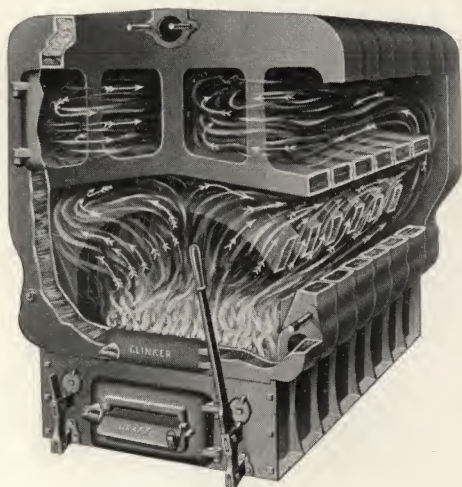
Additional measurements, pages 24 and 25.

For price list repairs, see pages 97 and 101.

Assembling chart, see pages 102 and 103.

Covering, see page 104.

# NATIONAL NOVUS SECTIONAL BOILERS



No. 8-36-W  
(Sectional View)

## Thirty-six Series Sectional Water Boilers

No. of Boiler	Rating See Note	List Price Complete	†Lgth. of Boiler Inches	No. of Secs.	Grate Area Sq. Ft.	Average Firepot Sq. Ft.	Size Foundation Inches	Outlets Inches
6-36-W	4400	\$620.00	49	6	11.50	14.69	41½x47½	2-5
7-36-W	5300	715.00	57½	7	13.75	17.61	41½x56	3-5
8-36-W	6200	810.00	66	8	16.00	20.54	41½x64½	3-5
9-36-W	7100	904.00	74½	9	18.25	23.46	41½x73	3-5
10-36-W	8000	999.00	83	10	20.50	26.38	41½x81	3-5

Height to top of outlet, 70 inches. Total width, 56 inches.

Size of smoke pipe, 16 inches.

†Add 14 inches to length to allow for smoke hood.

Arranged for pipe coil for heating water for domestic purposes.

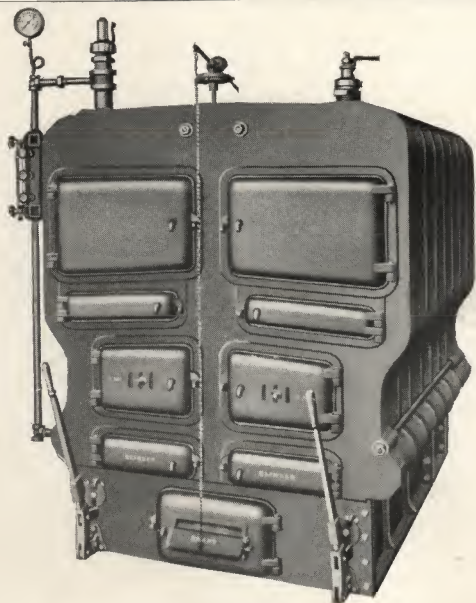
Additional measurements, pages 24 and 25.

For price list repairs, see pages 97 and 101.

Assembling chart, see pages 102 and 103.

Covering, see page 104.

# NATIONAL NOVUS SECTIONAL BOILERS



No. 48-8-S

## Forty-eight Series Sectional Steam Boilers

No. of Boiler	Rating See Note	List Price Complete	*Lgth. of Boiler Inches	No. of Secs.	Grate Area Sq. Ft.	Average Firepot Sq. Ft.	Size Foundation Inches	Outlets Inches
48- 6-S	5275	\$1249.00	59 $\frac{1}{4}$	6	18.23	22.50	54x57 $\frac{1}{2}$	2-6
48- 7-S	6300	1439.00	69 $\frac{3}{4}$	7	21.78	26.87	54x68	2-6
48- 8-S	7325	1629.00	80 $\frac{1}{4}$	8	25.33	31.25	54x78 $\frac{1}{2}$	3-6
48- 9-S	8350	1819.00	90 $\frac{3}{4}$	9	28.87	35.62	54x89	3-6
48-10-S	9375	2009.00	101 $\frac{1}{4}$	10	32.48	40.00	54x99 $\frac{1}{2}$	3-6
48-11-S	10400	2200.00	111 $\frac{3}{4}$	11	37.97	44.38	54x110	4-6

Height to top of outlet, 80 inches. Width of boiler, 67 inches. Height of water line, 68 inches. Size smoke pipe 20 inches.

Do not bush flow outlets on steam boilers. Connect full size to mains where velocity of flow exceeds 20 feet per second under maximum conditions of load.

Arranged for pipe coil for heating water for domestic purposes.

\*Add 20 inches to length to allow for smoke hood.

Sections are in halves.

Additional measurements, pages 24 and 25.

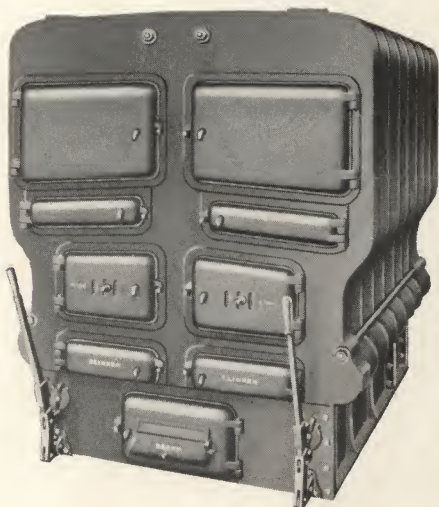
For price list repairs, see pages 97 and 101.

See page 23 information on piping.

Assembling chart, see pages 102 and 103.

Covering, see page 104.





No. 8-48-W

## Forty-eight Series Sectional Water Boilers

No. of Boiler	Rating See Note	List Price Complete	**Lgth. of Boiler Inches	*No. of Secs.	Grate Area Sq. Ft.	Average Firepot Sq. Ft.	Size Foundation Inches	Outlets Inches
6-48-W	8700	\$1220.00	59 $\frac{1}{4}$	6	18.23	22.50	54x57 $\frac{1}{2}$	2-6
7-48-W	10375	1403.00	69 $\frac{3}{4}$	7	21.78	26.87	54x68	2-6
8-48-W	12050	1586.00	80 $\frac{1}{4}$	8	25.33	31.25	54x78 $\frac{1}{2}$	3-6
9-48-W	13725	1769.00	90 $\frac{3}{4}$	9	28.87	35.62	54x89	3-6
10-48-W	15400	1952.00	101 $\frac{1}{4}$	10	32.48	40.00	54x99 $\frac{1}{2}$	3-6
11-48-W	17075	2136.00	111 $\frac{3}{4}$	11	37.97	44.38	54x110	4-6

Height to top of outlet, 80 inches. Width of boiler, 67 inches. Size smoke pipe, 20 inches.

Arranged for pipe coil for heating water for domestic purposes.

\*\*Add 20 inches to length to allow for smoke hood.

\*Sections are in halves.

Additional measurements, pages 24 and 25.

For price list repairs, see pages 97 and 101.

See page 23 for information on piping.

Assembling chart, see pages 102 and 103.

Covering, see page 104.



REAR VIEW  
With Three Half-  
Sections Removed

## Forty-eight Inch Sectional Boiler

FOR HEAVY DUTY

**N**OTICE the unobstructed grate and large firepot. Complete combustion is assured. This boiler has the double section, a feature that makes it easier to handle and to set up.

The grate is of the flat-surfaced grill pattern, adapted to the use of any kind of fuel. It is arranged with two shakers, on either side of the boiler. This permits operating either the front or back half of grate.

All heating surfaces are readily accessible for cleaning purposes.

Novus sectional boilers may be connected in a battery arrangement with equally efficient results.



REAR VIEW  
Showing how Return  
Connections must be  
Yoked Together

### Forty-eight Inch Sectional Boiler

FOR HEAVY DUTY

**N**ATIONAL boilers are constructed in such a manner as to secure the most efficient service with the greatest economy in consumption of fuel. The large and substantial smoke hood permits of an excellent draft and is easily attached to smoke pipe.

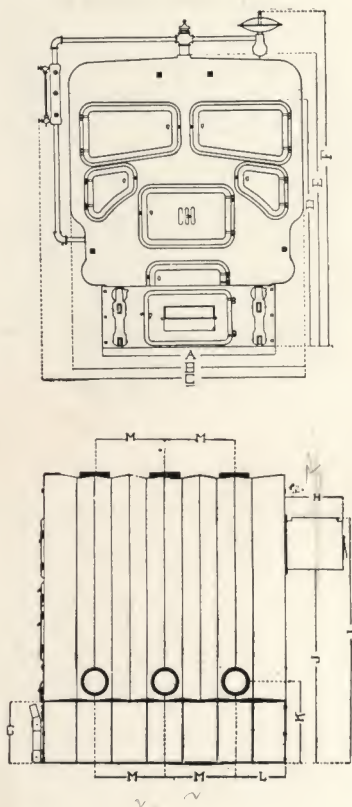
Pipe coils for heating water for domestic purposes may be inserted if necessary.

Sections are connected at top with heavy six-inch push nipples and at the bottom with heavy four-inch nipples.

This forty-eight inch National sectional is a very efficient, economical and durable boiler for heavy duty.



## Measurements



ON the opposite page is shown a table giving all measurements as applying to the illustrations. The outline used shows the measurements of both the Steam and Water types.

# NATIONAL NOVUS SECTIONAL BOILERS

## Measurements

THE following table gives all the measurements in inches on Novus Steam and Hot-Water Sectional Boilers.

### STEAM and WATER

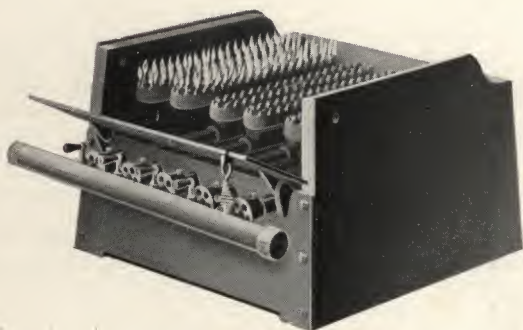
	20 Inches	25 Inches	31 Inches	36 Inches	48 Inches
A	22½	27¾	34	41½	54
B	28	36½	50	56	67
C	37½	44	58¼	65	76
D	47	49	52	60¼	68
E	54	57¼	61	70	80
F	65¾	74½	76½	90½	101½
G	12½	12⅞	12⅞	15	15
H	14	14	14	14	20
I	48½	49¼	53	58¾	67¾
J	41	36	41½	46¾	50¼
K	14½	16⅜	17	18⅜	....
L	8	9⅜	10⅞	11½	15
M	11¾	14	15⅞	17	21
Size of Fire Door	8½x13	10x15⅞	11x18	13x20	10½x17

## NATIONAL RADIUM GAS BOILERS

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Interior View Radium Boiler.



Radium Boiler Base with Burners Assembled.

# NATIONAL RADIUM GAS BOILERS



## Gas Water Boilers

### SERIES 1

No.	Rating	List Price	Supply Tapping Inches	Return Tapping Inches	Smoke Conne. Inches	Size of Base Inches	Burner Manifold Inches
41	400	\$ 61.00	2-2	2-2	4	12x14 $\frac{3}{4}$	1 $\frac{1}{4}$
51	500	76.00	2-2	2-2	4	15x14 $\frac{3}{4}$	1 $\frac{1}{4}$
61	600	91.00	2-2	2-2	4	18x14 $\frac{3}{4}$	1 $\frac{1}{4}$
71	700	106.00	2-2	2-2	4	21x14 $\frac{3}{4}$	1 $\frac{1}{4}$

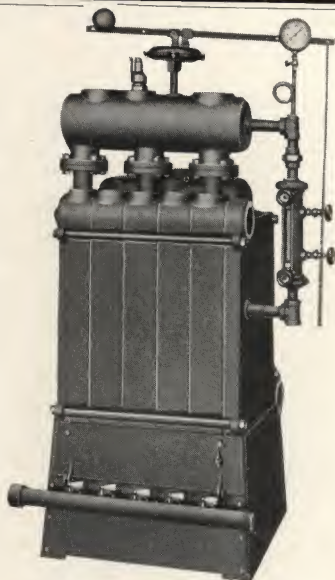
Size gas supply, 1 inch. Total height of boiler, 43 $\frac{1}{2}$  inches. Height to center of supply tapping, 37 $\frac{3}{4}$  inches. Height to center of return tapping, 22 $\frac{3}{8}$  inches.

No trimmings furnished with water boilers.

List price repairs, page 100.

Covering, see page 104.

# NATIONAL RADIUM GAS BOILERS



## Gas Steam Boilers

SERIES 2

No.	Rating	List Price	Supply Taps. Inches	Return Taps. Inches	Size Smoke Hood Inches	Size Base Inches	Burner Manifold Inches
4	450	\$171.50	2-3	2-3	1-5	18x25	1 1/4
5	575	211.00	2-3	2-3	1-7	22x25	1 1/4
6	700	250.50	2-3	2-3	1-7	26x25	1 1/2
7	825	290.00	2-3	2-3	1-7	30x25	1 1/2
8	950	329.50	2-3	2-3	1-7	34x25	2
9	1075	369.00	2-3	2-3	2-7	38x25	2
10	1200	408.50	2-3	2-3	2-7	42x25	2
11	1325	448.00	2-3	2-3	2-7	46x25	2
12	1450	487.50	2-3	2-3	2-7	50x25	2
13	1575	527.00	2-3	2-3	2-7	54x25	2
14	1700	566.50	2-3	2-3	2-7	58x25	2
15	1825	606.00	2-3	2-3	2-7	62x25	2
16	1950	645.50	2-3	2-3	2-7	66x25	2 1/2
17	2075	685.00	2-3	2-3	2-7	70x25	2 1/2
18	2200	724.50	2-3	2-3	2-7	74x25	2 1/2
19	2325	764.00	2-3	2-3	2-7	78x25	2 1/2
20	2450	803.50	2-3	2-3	2-7	82x25	2 1/2

Height of water line, 36 inches. Height to top of supply tapping, 57 inches. Height to center of return tapping, 16 1/2 inches. Size gas supply 4 to 8 sec., 1 in.; 9 to 12 sec., 1 1/4 in.; 13 to 20 sec., 1 1/2 in.

All steam boilers furnished with steam header and a complete set of trimmings.

List price repairs, page 100.

Covering, see page 104.



# NATIONAL RADIUM GAS BOILERS



## Gas Water Boilers

### SERIES 2

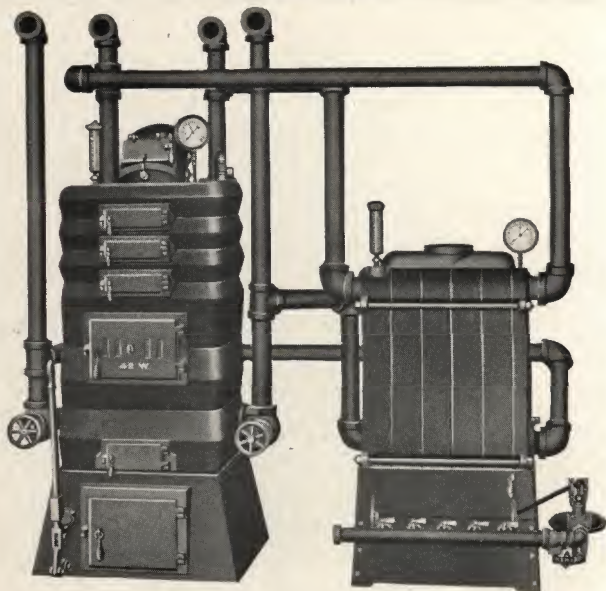
No.	Rating	List Price	Supply Taps. Inches	Return Taps. Inches	Size Smoke Hood Inches	Size of Base Inches	Burner Manifold Inches
4	750	\$120.50	2-3	2-3	1-5	18x25	1 $\frac{1}{4}$
5	950	151.00	2-3	2-3	1-7	22x25	1 $\frac{1}{4}$
6	1150	181.50	2-3	2-3	1-7	26x25	1 $\frac{1}{2}$
7	1350	212.00	2-3	2-3	1-7	30x25	1 $\frac{1}{2}$
8	1550	242.50	2-3	2-3	1-7	34x25	2
9	1750	273.00	2-3	2-3	2-7	38x25	2
10	1950	303.50	2-3	2-3	2-7	42x25	2
11	2150	334.00	2-3	2-3	2-7	46x25	2
12	2350	364.50	2-3	2-3	2-7	50x25	2
13	2550	395.00	2-3	2-3	2-7	54x25	2
14	2750	425.50	2-3	2-3	2-7	58x25	2
15	2950	456.00	2-3	2-3	2-7	62x25	2
16	3150	486.50	3-3	2-3	2-7	66x25	2 $\frac{1}{2}$
17	3350	517.00	3-3	2-3	2-7	70x25	2 $\frac{1}{2}$
18	3550	547.50	3-3	2-3	3-7	74x25	2 $\frac{1}{2}$
19	3750	578.00	3-3	2-3	3-7	78x25	2 $\frac{1}{2}$
20	3950	608.50	3-3	2-3	3-7	82x25	2 $\frac{1}{2}$

Height to center of supply tapping, 40 $\frac{3}{4}$  inches. Height to center of return tapping, 16 $\frac{1}{2}$  inches. Distance from center of supply to center of return tapping, 24 $\frac{1}{4}$  inches. Height of boiler, 46 inches. Size gas supply 4 to 8 sec., 1 in.; 9 to 12 sec., 1 $\frac{1}{4}$  in.; 13 to 20 sec., 1 $\frac{1}{2}$  in.

List price repairs, page 100.

Covering, see page 104.

## NATIONAL RADIUM GAS BOILERS

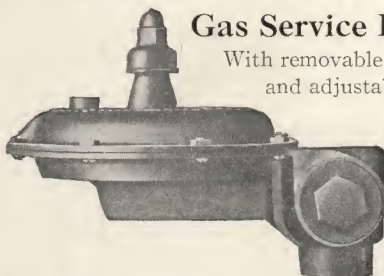


**Combination Gas and Coal Heating**

Gas and coal boilers can be conveniently yoked together and operated either separately or as one unit for heating purposes. By such an arrangement both boilers can be utilized in extremely cold weather or the coal boiler is ready for instant service in the event of any shortage in gas or reduction in gas pressure.

## Gas Service Regulators

With removable seat and valve  
and adjustable stem.



**Simple  
Compact  
Durable  
Sensitive  
Powerful**

Size, Inches.....	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2
Capacity, cubic feet.....	500	535	750	1860	4200
List without Mercury Seal....	\$7.00	\$7.00	\$18.00	\$18.00	\$36.00
List with Mercury Seal.....	7.25	7.25	.....	.....	.....



## Ratings

The ratings of **National** Boilers are based upon tests made with anthracite coal and provide that all piping (mains and risers, flow and return) in addition to the direct radiation to be used, shall be figured as radiating surface in estimating the size of boiler required.

When a pipe coil or cast-iron section is introduced into the firepot for the purpose of heating water for domestic use, additional capacity should be figured in determining size of boiler, viz., in the case of **steam boilers, 1¼ square feet of direct radiation for each gallon of water to be thus heated,** and in the case of **water boilers, 2 square feet of direct radiation for each gallon of water to be thus heated,** according to the capacity of the tank to which coil or section is connected.

When indirect radiation is to be used, not less than 75 per cent. increase over direct radiation should be figured in determining the size of boiler required.

In rating steam boilers as above, it is understood that an average pressure of 2 pounds will be maintained at the boiler. In rating water boilers as above, it is understood that the mean temperature of the water at the boiler will be 180 degrees Fahrenheit.

## Guarantee

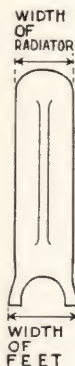
These boilers are guaranteed only to the extent of furnishing new castings for any found defective in manufacture. They are conservatively rated according to the accepted standards, but on account of the varying conditions surrounding their installation, we do not guarantee our boilers except as above.

## Recommendation

Both on account of increased efficiency and in the interest of greater economy, we strongly recommend that all boilers be thoroughly protected by a substantial covering of asbestos.

## Single-Column

### Hot-Water and Steam Types



LENGTH  
PER  
SECTION



National Premo Radiators tapped 2 inches and bushed to sizes required. Width of radiator,  $4\frac{1}{16}$  inches. Width of feet, 5 inches. Assembled at the top with  $1\frac{1}{2}$ -inch and bottom with 2-inch National Push Nipples of malleable cast-iron.

Hospital radiator also regular tappings, see page 43.

# Sizes—Single-Column Radiators

No. of Sections	†Length 2½ in. per Sec.	Square Feet — Heating Surface				
		38-in. Height 3 sq. ft. per Sec.	32-in. Height 2½ sq. ft. per Sec.	26-in. Height 2 sq. ft. per Sec.	23-in. Height 1⅔ sq. ft. per Sec.	20-in. Height 1½ sq. ft. per Sec.
2	5	6	5	4	3⅓	3
3	7½	9	7½	6	5	4½
4	10	12	10	8	6⅔	6
5	12½	15	12½	10	8⅓	7½
6	15	18	15	12	10	9
7	17½	21	17½	14	11⅔	10½
8	20	24	20	16	13⅓	12
9	22½	27	22½	18	15	13½
10	25	30	25	20	16⅔	15
11	27½	33	27½	22	18⅓	16½
12	30	36	30	24	20	18
13	32½	39	32½	26	21⅔	19½
14	35	42	35	28	23⅓	21
15	37½	45	37½	30	25	22½
16	40	48	40	32	26⅔	24
17	42½	51	42½	34	28⅓	25½
18	45	54	45	36	30	27
19	47½	57	47½	38	31⅔	28½
20	50	60	50	40	33⅓	30
21	52½	63	52½	42	35	31½
22	55	66	55	44	36⅔	33
23	57½	69	57½	46	38⅓	34½
24	60	72	60	48	40	36
25	62½	75	62½	50	41⅔	37½
26	65	78	65	52	43⅓	39
27	67½	81	67½	54	45	40½
28	70	84	70	56	46⅔	42
29	72½	87	72½	58	48⅓	43½
30	75	90	75	60	50	45
31	77½	93	77½	62	51⅔	46½
32	80	96	80	64	53⅓	48

†Add ½ inch to length for each bushing.

## Two-Column

Hot-Water and Steam Types



National Premo Radiators tapped 2 inches and bushed to sizes required. Width of radiator,  $7\frac{3}{8}$  inches. Width of feet,  $7\frac{5}{8}$  inches. Assembled with 2-inch National Push Nipples of malleable cast-iron.

Hospital radiator also regular tapplings, see page 43.

## Sizes—Two-Column Radiators

No. of Sec- tions	† 2½ in. per Sec. Length	Square Feet — Heating Surface					
		45-in. Height 5 sq. ft. per Sec.	38-in. Height 4 sq. ft. per Sec.	32-in. Height 3½ sq. ft. per Sec.	26-in. Height 2⅔ sq. ft. per Sec.	23-in. Height 2½ sq. ft. per Sec.	20-in. Height 2 sq. ft. per Sec.
2	5	10	8	6⅔	5⅓	4⅔	4
3	7½	15	12	10	8	7	6
4	10	20	16	13⅓	10⅔	9⅓	8
5	12½	25	20	16⅔	13⅓	11⅔	10
6	15	30	24	20	16	14	12
7	17½	35	28	23⅓	18⅔	16⅓	14
8	20	40	32	26⅔	21⅓	18⅔	16
9	22½	45	36	30	24	21	18
10	25	50	40	33⅓	26⅔	23⅓	20
11	27½	55	44	36⅔	29⅓	25⅔	22
12	30	60	48	40	32	28	24
13	32½	65	52	43⅓	34⅔	30⅓	26
14	35	70	56	46⅔	37⅓	32⅔	28
15	37½	75	60	50	40	35	30
16	40	80	64	53⅓	42⅔	37⅓	32
17	42½	85	68	56⅔	45⅓	39⅔	34
18	45	90	72	60	48	42	36
19	47½	95	76	63⅓	50⅔	44⅓	38
20	50	100	80	66⅔	53⅓	46⅔	40
21	52½	105	84	70	56	49	42
22	55	110	88	73⅓	58⅔	51⅓	44
23	57½	115	92	76⅔	61⅓	53⅔	46
24	60	120	96	80	64	56	48
25	62½	125	100	83⅓	66⅔	58⅓	50
26	65	130	104	86⅔	69⅓	60⅔	52
27	67½	135	108	90	72	63	54
28	70	140	112	93⅓	74⅔	65⅓	56
29	72½	145	116	96⅔	77⅓	67⅔	58
30	75	150	120	100	80	70	60
31	77½	155	124	103⅓	82⅔	72⅓	62
32	80	160	128	106⅔	85⅓	74⅔	64

†Add ½ inch to length for each bushing.



## Three-Column

### Hot-Water and Steam Types



National Premo Radiators tapped 2 inches and bushed to sizes required. Width of radiator,  $9\frac{1}{8}$  inches. Width of feet,  $9\frac{5}{16}$  inches. Assembled with 2-inch National Push Nipples of malleable cast-iron.

Hospital radiator also regular tapings, see page 43.

## Sizes—Three-Column Radiators

No. of Sec- tions	† Length 2½ in. per Sec.	Square Feet — Heating Surface					
		45-in. Height 6 sq. ft. per Sec.	38-in. Height 5 sq. ft. per Sec.	32-in. Height 4½ sq. ft. per Sec.	26-in. Height 3¾ sq. ft. per Sec.	22-in. Height 3 sq. ft. per Sec.	18-in. Height 2¼ sq. ft. per Sec.
2	5	12	10	9	7½	6	4½
3	7½	18	15	13½	11¼	9	6¾
4	10	24	20	18	15	12	9
5	12½	30	25	22½	18¾	15	11¼
6	15	36	30	27	22½	18	13½
7	17½	42	35	31½	26¼	21	15¾
8	20	48	40	36	30	24	18
9	22½	54	45	40½	33¾	27	20¼
10	25	60	50	45	37½	30	22½
11	27½	66	55	49½	41¼	33	24¾
12	30	72	60	54	45	36	27
13	32½	78	65	58½	48¾	39	29¼
14	35	84	70	63	52½	42	31½
15	37½	90	75	67½	56¼	45	33¾
16	40	96	80	72	60	48	36
17	42½	102	85	76½	63¾	51	38¼
18	45	108	90	81	67½	54	40½
19	47½	114	95	85½	71¼	57	42¾
20	50	120	100	90	75	60	45
21	52½	126	105	94½	78¾	63	47¼
22	55	132	110	99	82½	66	49½
23	57½	138	115	103½	86¼	69	51¾
24	60	144	120	108	90	72	54
25	62½	150	125	112½	93¾	75	56¼
26	65	156	130	117	97½	78	58½
27	67½	162	135	121½	101¼	81	60¾
28	70	168	140	126	105	84	63
29	72½	174	145	130½	108¾	87	65¼
30	75	180	150	135	112½	90	67½
31	77½	186	155	139½	116¼	93	69¾
32	80	192	160	144	120	96	72

†Add ½ inch to length for each bushing.

**Four-Column**  
Hot-Water and Steam Type



National Premo Radiators tapped 2 inches and bushed to sizes required. Width of radiator,  $11\frac{3}{4}$  inches. Width of feet, 12 inches. Assembled with 2-inch National Push Nipples of malleable cast-iron.

Regular tappings, see page 43.

# Sizes—Four-Column Radiators

No. of Sec- tions	†Length 3 in. per Sec.	Square Feet — Heating Surface					
		45-in. Height 10 sq. ft. per Sec.	38-in. Height 8 sq. ft. per Sec.	32-in. Height 6½ sq. ft. per Sec.	26-in. Height 5 sq. ft. per Sec.	22-in. Height 4 sq. ft. per Sec.	18-in. Height 3 sq. ft. per Sec.
2	6	20	16	13	10	8	6
3	9	30	24	19½	15	12	9
4	12	40	32	26	20	16	12
5	15	50	40	32½	25	20	15
6	18	60	48	39	30	24	18
7	21	70	56	45½	35	28	21
8	24	80	64	52	40	32	24
9	27	90	72	58½	45	36	27
10	30	100	80	65	50	40	30
11	33	110	88	71½	55	44	33
12	36	120	96	78	60	48	36
13	39	130	104	84½	65	52	39
14	42	140	112	91	70	56	42
15	45	150	120	97½	75	60	45
16	48	160	128	104	80	64	48
17	51	170	136	110½	85	68	51
18	54	180	144	117	90	72	54
19	57	190	152	123½	95	76	57
20	60	200	160	130	100	80	60
21	63	210	168	136½	105	84	63
22	66	220	176	143	110	88	66
23	69	230	184	149½	115	92	69
24	72	240	192	156	120	96	72
25	75	250	200	162½	125	100	75
26	78	260	208	169	130	104	78
27	81	270	216	175½	135	108	81
28	84	280	224	182	140	112	84
29	87	290	232	188½	145	116	87
30	90	300	240	195	150	120	90
31	93	310	248	201½	155	124	93
32	96	320	256	208	160	128	96

†Add ½ inch to length for each bushing.

## Five-Column

Window-Water and Steam Type



### Sizes—Five-Column Radiators

National Premo Radiators, tapped 2 inches and bushed to sizes required. Width of radiator, 13 inches. Width of feet, 13 inches. Assembled at the top with 1½-inch and at the bottom with 2-inch National Push Nipples of malleable cast-iron.

Regular tapings, see page 43.

No. of Sections	†Length 3 inches per Section	Heating Surface — Square Feet		
		20-in. Height 5 sq. ft. per Section	16-in. Height 3¾ sq. ft. per Section	13-in. Height 3 sq. ft. per Section
2	6	10	7½	6
3	9	15	11¼	9
4	12	20	15	12
5	15	25	18¾	15
6	18	30	22½	18
7	21	35	26¼	21
8	24	40	30	24
9	27	45	33¾	27
10	30	50	37½	30

†Add ½ inch to length for each bushing.



## Tappings For Premo Radiators

Supply	One-Pipe Work	Steam Radiators
Up to 24 square feet, inclusive.....		1 inch
Above 24, up to 60 square feet.....		1 1/4 inches
Above 60, up to 100 square feet.....		1 1/2 inches
Above 100 square feet.....		2 inches

	Two-Pipe Work	Supply and Return
Up to 48 square feet, inclusive.....	1	x 3/4 inch
Above 48, up to 96 square feet.....	1 1/4	x 1 inch
Above 96 square feet.....	1 1/2	x 1 1/4 inches

	Water Radiators	Tapped for Supply and Return
Up to 40 square feet, inclusive.....	1	x 1 inch
Above 40, up to 72 square feet.....	1 1/4	x 1 1/4 inches
Above 72 square feet.....	1 1/2	x 1 1/2 inches

### Air Valve and Vapor Tappings

All air-valve tappings of Direct Radiators are regularly made 1/8 inch.  
Vapor tappings, top and bottom opposite ends; supply 3/4-in., return 1/2-in.

### Distance from Floor to Center of Bottom Tappings

Pattern	Water Supply and Return	Single-Pipe Steam	Two-Pipe Steam	
			Supply	Return
†Premo 1-Column.....	4 1/2	4	4 1/2	4
Premo 2-Column.....	4 1/2	4	4 1/2	4
Premo 3-Column.....	4 1/2	4	4 1/2	4
Premo 4-Column.....	4 1/2	4 1/2	4 1/2	4 1/2
Premo Window 5-Column.....	3	3	3	3

Note: All Semi-Direct Radiators are furnished with 6-inch legs. Add 1 1/2 inches to above measurements on radiators of this type.

### Double Hub Tappings

Measurements, Inches	2-Column	3-Column	4-Column	5-Column
Center to Center of Tapping.....	4	4	4	4
Center Tapping to Floor.....	4 1/2	4 1/2	4 1/2	3 1/2

### Top and Bottom Tappings for Premo Radiators

The figures given below indicate the distance between center of upper and lower tappings for top feed and bottom return at same end on all Premo Water Radiators.

Height Inches	Single Column Inches	Two-Column Inches	Three-Column Inches	Four-Column Inches	Five-Column Window Inches
45	..	37	37	37	....
38	31	31	31	31	....
32	25	25	25	25	....
26	19	19	19	19	....
23	16	16	..	..	....
22	..	..	15	15	....
20	13	13	..	..	15 3/32
18	..	..	11	11	..
16	..	..	..	..	11 19/64
13	..	..	..	..	8 5/16

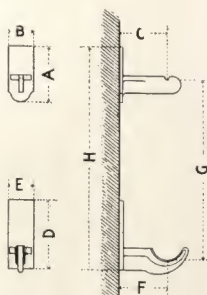
†These measurements are in inches.

## Premo Single-Column Radiator

Supported on Concealed Brackets



Where it is necessary to support radiators in such a manner that they will hang closely to the wall and also be elevated from the floor, we furnish concealed brackets for single-column, two-column, three-column and four-column patterns. Measurements, see pages 45 and 111. A set consists of one top and one bottom bracket as shown at side of radiator. Two sets will support medium-sized radiators.



## Concealed Brackets for Premo Radiators

Dimensions	Top-In.			Dimension—"G"—Inches							
	A	B	C	45	38	32	26	23	22	20	18
Single-Column.....	3 <sup>7</sup> / <sub>8</sub>	2 <sup>1</sup> / <sub>2</sub>	3 <sup>1</sup> / <sub>4</sub>	...	30	24	18	15	...	12	...
Two-Column.....	5 <sup>5</sup> / <sub>8</sub>	2 <sup>1</sup> / <sub>2</sub>	4 <sup>3</sup> / <sub>4</sub>	35 <sup>7</sup> / <sub>8</sub>	29 <sup>7</sup> / <sub>8</sub>	23 <sup>7</sup> / <sub>8</sub>	17 <sup>7</sup> / <sub>8</sub>	14 <sup>7</sup> / <sub>8</sub>	...	11 <sup>7</sup> / <sub>8</sub>	...
Three-Column.....	5 <sup>5</sup> / <sub>8</sub>	2 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>16</sub>	36 <sup>1</sup> / <sub>4</sub>	30 <sup>1</sup> / <sub>4</sub>	24 <sup>1</sup> / <sub>4</sub>	18 <sup>1</sup> / <sub>4</sub>	...	14 <sup>1</sup> / <sub>4</sub>	...	10 <sup>1</sup> / <sub>4</sub>
Four-Column.....	5 <sup>5</sup> / <sub>8</sub>	2 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>16</sub>	36 <sup>1</sup> / <sub>8</sub>	30 <sup>1</sup> / <sub>8</sub>	24 <sup>1</sup> / <sub>8</sub>	18 <sup>1</sup> / <sub>8</sub>	...	14 <sup>1</sup> / <sub>8</sub>	...	10 <sup>1</sup> / <sub>8</sub>

Dimensions	Bottom-In.			Dimension—"H"—Inches							
	D	E	F	45	38	32	26	23	22	20	18
Single-Column.....	4 <sup>1</sup> / <sub>4</sub>	2 <sup>1</sup> / <sub>2</sub>	3 <sup>1</sup> / <sub>4</sub>	...	34	28	22	19	...	16	...
Two-Column.....	7	2 <sup>1</sup> / <sub>2</sub>	4 <sup>3</sup> / <sub>4</sub>	40 <sup>1</sup> / <sub>8</sub>	34 <sup>1</sup> / <sub>8</sub>	28 <sup>1</sup> / <sub>8</sub>	22 <sup>1</sup> / <sub>8</sub>	19 <sup>1</sup> / <sub>8</sub>	...	16 <sup>1</sup> / <sub>8</sub>	...
Three-Column.....	7	2 <sup>1</sup> / <sub>2</sub>	5 <sup>3</sup> / <sub>4</sub>	41	35	29	23	...	19	...	15
Four-Column.....	7	2 <sup>1</sup> / <sub>2</sub>	7 <sup>1</sup> / <sub>4</sub>	41 <sup>1</sup> / <sub>8</sub>	35 <sup>1</sup> / <sub>8</sub>	29 <sup>1</sup> / <sub>8</sub>	23 <sup>1</sup> / <sub>8</sub>	...	19 <sup>1</sup> / <sub>8</sub>	...	15 <sup>1</sup> / <sub>8</sub>



## Radiator Pedestals

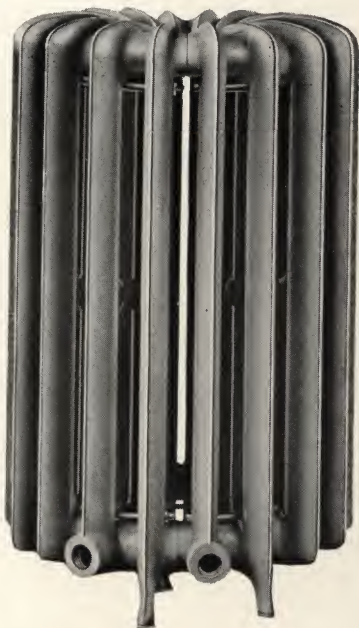
Pedestals to fit under any pattern of Premo Radiators can be furnished in the following heights: 1 inch, 1 <sup>1</sup>/<sub>2</sub> inches, 2 inches, 2 <sup>1</sup>/<sub>2</sub> inches, 3 inches, 3 <sup>1</sup>/<sub>2</sub> inches, 4 inches, 4 <sup>1</sup>/<sub>2</sub> inches, 5 inches and 5 <sup>1</sup>/<sub>2</sub> inches.

## Premo Corner Radiators



Corner Radiators made in all patterns and heights for any angle. We use four sections for making a 90-degree angle corner on all patterns except four and five-column; on these patterns we use six sections. In ordering corner radiators, send sketch giving the angle of corner, and distance radiator can extend in each direction, also show which end of radiator is to have supply leg. Measurements of 90-degree Corner Radiators, see page 114.

# NATIONAL PREMO RADIATOR



## Premo Circular Radiator

Made in all heights of one, two or three-column patterns.

Premo Circular Radiators are furnished in two pieces, forming two separate radiators, which can be placed around post or column. Tapping on each half is furnished regular unless otherwise ordered.

### Dimensions Three-Column

No. Sections	Outside Diameter Legs Inches	Inside Diameter Legs Inches	No. Sections	Outside Diameter Legs Inches	Inside Diameter Legs Inches
16	24½	6	24	32½	14
18	26½	8	26	34½	16
20	28½	10	28	36½	18
22	30½	12	30	38½	20



## Premo Semi-Direct Radiator

With Improved Cold Air Boxes



Openings for fresh-air inlets from back of radiators are as follows:

5-section, $4\frac{3}{4}$ x $3\frac{1}{4}$ inch	10-section, $10\frac{1}{4}$ x $3\frac{1}{4}$ inch
6-section, $7\frac{1}{4}$ x $3\frac{1}{4}$ inch	11-section, $12\frac{1}{4}$ x $3\frac{1}{4}$ inch
7-section, $7\frac{1}{4}$ x $3\frac{1}{4}$ inch	12-section, $12\frac{1}{4}$ x $3\frac{1}{4}$ inch
8-section, $8\frac{1}{4}$ x $3\frac{1}{4}$ inch	13-section, $16\frac{1}{4}$ x $3\frac{1}{4}$ inch
9-section, $10\frac{1}{4}$ x $3\frac{1}{4}$ inch	14-section, $16\frac{1}{4}$ x $3\frac{1}{4}$ inch

All the above are outside measurements and  $\frac{1}{2}$  inch above the floor line.

Bottom or floor openings may be made any width up to 5 inches, measuring from back of base, and any length up to 29 inches for a 14-section base, deducting  $2\frac{1}{2}$  inches for each section on shorter bases.

### Improved Cold Air Boxes

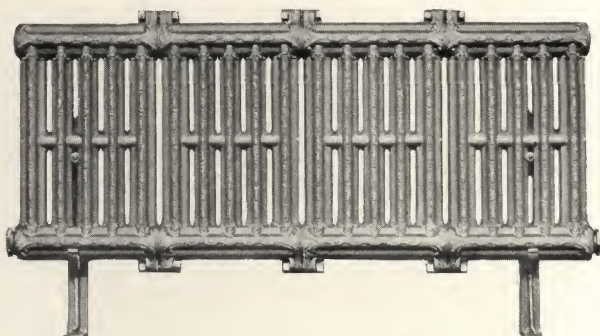
These boxes are substantially constructed, being both storm and insect proof. Outside measurements are: No. 1,  $5\frac{1}{2}$  x 17 inches, No. 2, 8 x 25 inches.

## Premo Two-Column Hospital Radiator

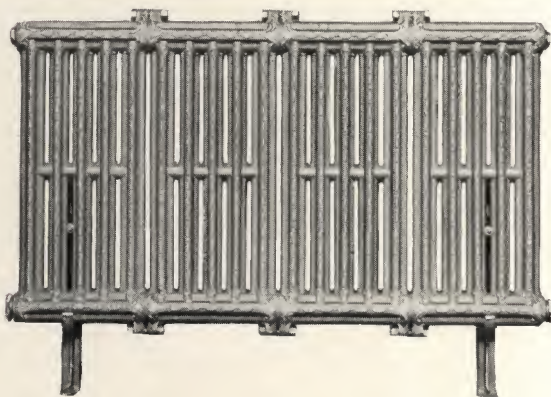


Premo Hospital Radiators are made in one, two and three-column patterns. These radiators measure 3 inches from center to center of sections. This additional air space facilitates cleaning between the sections. With this provision and being perfectly plain they are sanitary and especially adapted to hospital heating.

## For Steam or Water



Four 14½-Inch Sections, National Wall Radiator



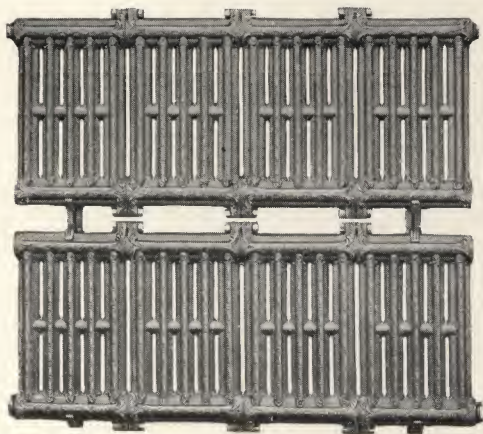
Four 28-inch Sections, National Wall Radiator

Note: The NOVUS WALL RADIATOR is particularly adapted for heating ships and is extensively used for this purpose. Owing to its compact construction and its push nipple joint which permits of increasing or decreasing size of radiators on the job, it has become very popular among shipbuilders.

# NATIONAL NOVUS WALL RADIATOR

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## For Steam or Water



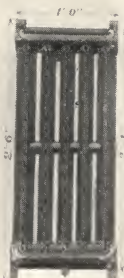
Eight 20-inch Sections, National Wall Radiator

**NATIONAL**  
Wall Radiator

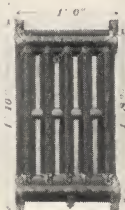
Sizes



36-inch



28-inch



20-inch



14½-inch



## Sizes Novus Wall Radiator

High Inches	Wide Inches	Height Including Lugs, Inches	Surface Sq. Ft.
36	12	38	9
28	12	30	7
20	12	22	5
14½	12	16½	4

Distance from center to center top and bottom tapping.

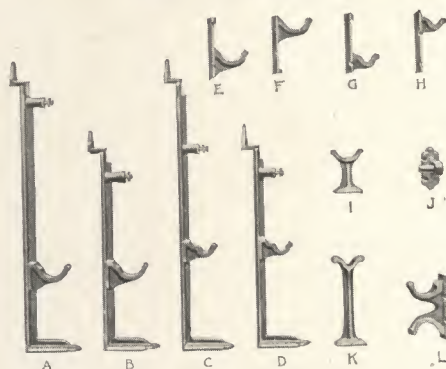
14½" — 11¾" center to center      28" — 25⅛" center to center.  
20" — 17¼" center to center.      36" — 33" center to center.

Width of Sections ..... 3 inches

Distance from Wall to Center of Tapping Wall Brackets ..... 2⅞ inches

Pedestal Brackets ..... 3⅞ inches

## Novus Wall Radiator Brackets and Supports



A and C Pedestal Supports are 26 inches high and B and D Pedestal Supports 20 inches high.

A and B both made to support radiator either 4, 6 or 8 inches from floor to center of opening. A for 28 inch and 36 inch sections only; B for 14½ and 20 inch sections only.

C and D. These supports can only be used for single radiators with bars running horizontally and outlets on bottom side. Distance from floor to bottom of radiator, 8 inches.

E and F. Plain Wall Brackets. E used as bottom bracket; F used as top bracket.

G and H. Can only be used on single sections with bars running horizontally.

I. Small pedestal support. From floor to center of outlet, 4½ inches.

J. Top Bracket to fit into opening on the lug on end sections. Can also be used for bottom brackets on small radiators.

K. Pedestal Support can only be used for single sections with bars running horizontally, distance from floor to bottom of radiator, 7 inches.

L. Special Bracket to be used where one tier of sections is placed above the other.



# NATIONAL NOVUS PLATE WARMER



This combined plate warmer and pantry radiator is particularly desirable for restaurant kitchens. In the private residence it is a necessity and its small cost is more than made up in the service given.

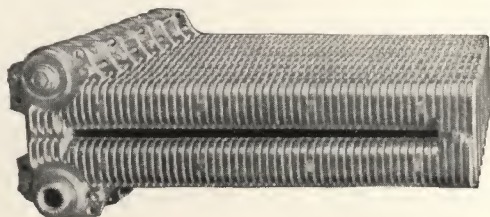
The National wall radiator sections are used to form the shelves. Any number of shelves may be ordered and one or more sections may be used for each shelf.

Special sizes can be made up, price for which will be quoted on application.

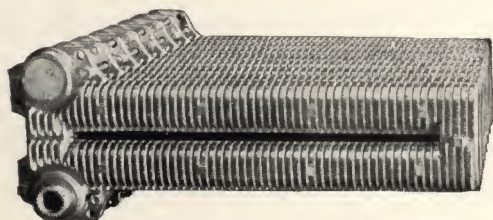
## Price List and Dimensions, Standard Sizes.

No.	Shelves	Heating Surface Feet	Length Inches	Height Inches	Width Inches	Price
No. 1—22	1	5	22	8	16	\$13.00
No. 2—22	2	11	22	18	16	26.00
No. 3—22	3	17	22	28	16	40.00
No. 1—30	1	7	30	8	16	16.00
No. 2—30	2	15	30	18	16	32.00
No. 3—30	3	23	30	28	16	48.00
No. 1—38	1	9	38	8	16	19.00
No. 2—38	2	19	38	18	16	38.00
No. 3—38	3	29	38	28	16	58.00

# NATIONAL INDIRECT RADIATOR



National Indirect Radiator, Somerset Type, for Steam and Water



National Indirect Radiator, Bedford Type, for Steam only

## Sizes

Somerset type is made in three sizes, for either steam or water. Bedford type is made in three sizes, for steam only.

Section Feet	Length Overall Inches	Height at Connecting End Inches	Height at Section Inches	Price per Section	Price per Foot
15	37 $\frac{5}{8}$	14 $\frac{1}{4}$	9 $\frac{1}{4}$	\$7.50	\$0.50
12 $\frac{1}{2}$	31 $\frac{5}{8}$	14 $\frac{1}{4}$	9 $\frac{1}{4}$	6.25	.50
10	25 $\frac{5}{8}$	14 $\frac{1}{4}$	9 $\frac{1}{4}$	5.00	.50

## Especially Adapted for Cooling Coils

Where Steam is Furnished from Central Heating Plants

**M**ECHANICAL excellence and labor-saving are two big advantages of National Somerset and Bedford Indirect radiators.

The sections are drawn together by means of short bolts as illustrated. An ordinary monkey wrench is the only tool required. This appeals to the man on the job especially if he has had experience with right and left-hand screw nipple Indirect radiation of the water type.

National Indirect radiator sections are assembled with 2-inch National push nipples of heavy resilient malleable cast-iron. The joint made will remain absolutely tight.

Width each section occupies in stack  $3\frac{1}{2}$  inches, or when specially ordered, to give additional air area, this can be increased to 4 inches or  $4\frac{1}{2}$  inches by using extra long nipples.

### Tappings

All outlets for feed and return are tapped 2 inches right-hand and bushed to size, according to regular tapping list for National Premo radiators. If location of tapping is desired other than regular, special tapping can be supplied with top inlet or bottom outlet  $1\frac{1}{2}$  inches or smaller.

### Assembling

Make sure that the letters or marks designating the pattern always face the same way. This insures perfect alignment.

For convenience in handling, indirects are shipped loose, unless expressly ordered to be built into stacks, when a charge of one cent per foot is made to cover cost of assembling. Customers should be careful to specify the number of stacks into which the sections are to be built, so that necessary vent sections may be shipped.

# NATIONAL Push Nipple



**A Push Steel Nipple in Use Less Than Four Years**

**P**ROBABLY no other feature of cast-iron radiator construction has been so widely discussed—nor as much misrepresented—as the radiator nipple and the proper method of making a permanent tight joint between the sections.

Up to 1905 fully 90 per cent of all radiators manufactured were assembled with push nipples of thin steel. The effect of corrosion in some localities limited the life of the steel push nipples to less than four years.

When the disadvantages of steel nipples became apparent the malleable cast-iron nipple was the object of experiment. It was found that this metal was practically like that of the radiator and its life would therefore be as long as that of the radiator. Its resiliency was a commendable feature.

Due in great measure to the fact that malleable castings could not be made satisfactory at the time or that they could not be finished with a degree of perfection necessary to make an absolutely tight joint—the push nipple was generally abandoned for the screw nipple, though the metal used was malleable cast-iron.

After many discouraging experiments the National push nipple of resilient malleable cast-iron was perfected. The statement that the National Radiator Company was the first to successfully use this perfect metal-to-metal joint is as yet unchallenged. The joint made by the National push nipple is logical—both from a standpoint of manufacture and actual use. **National push nipples need no gasket or other form of packing to insure against leaks—the nipple itself makes a permanent, watertight joint.**

An important reason for National push nipple assembled radiators is that they can be taken apart and put together again, when necessary, in one-third of the time required of screw nipple assembled radiators—and no special tools are required. Oftentimes a radiator to be installed on the second, third or higher stories is too heavy to handle and must be taken apart. This is one reason why radiators assembled with National push nipples are particularly desired by the steam fitters.



**The National Push Nipple**



## NATIONAL RADIATOR NIPPLES

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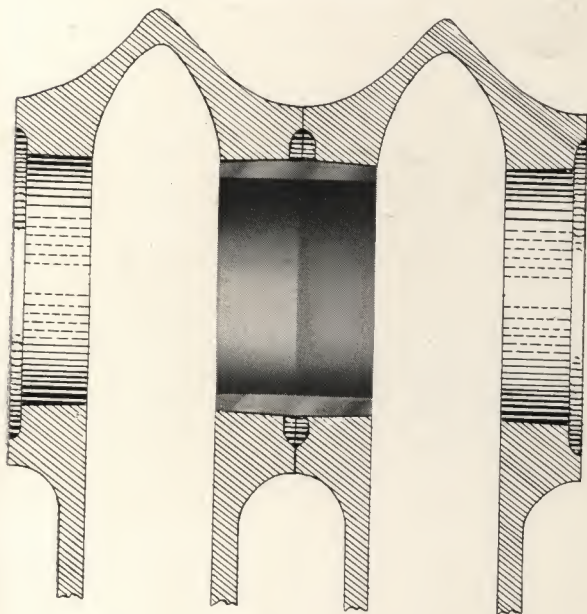
National push nipples are made of heavy resilient malleable cast-iron finished to a thousandth part of an inch and fit accurately in the machined openings. They may be used in hand or machine assembling. When used for hand assembling special repressed nipples are furnished. In every instance the joint made will remain absolutely tight under any condition. All National Radiators are assembled with National Push Nipples.

Some 5,000 individual National radiators were installed in the Equitable building, New York, in 1914. This is said to be the largest office building in the world.

So far not one "nipple" leak has developed or is ever likely to develop in these 5,000 National Radiators because the National push nipple is the logical method of joining cast-iron radiator sections.

National apparatus is made so well that the user will get the most service at as small expense as possible. Three plants, at Johnstown, Pa., New Castle, Pa., and Trenton, N. J., are running to full capacity. This seems to be reason enough that National boilers and radiators are living up to the sales argument, "more heat—quicker and cheaper."

**Sectional View of National Push Nipple Joint of  
National Premo Radiator**





## Suggestions for Ordering Radiators

**W**HEN ordering National radiators time can be saved by following the directions given below. Printed forms for ordering will be mailed customers on application.

Give full name of radiator.

With every order give full shipping instructions.

Always state whether for steam or water and give heights. If for steam, specify whether for one or two-pipe work.

When ordering leg sections advise whether for supply or return connection. State size of tapping required and whether for use on one or two-pipe steam or for water.

When ordering leg or intermediate sections it is desirable to give date of invoice covering radiators for which the loose sections are required.

In ordering radiators keep as close as possible to regular goods—special tappings and shapes frequently cause delay.

For convenience in handling avoid ordering Direct radiators in larger than 32 section units. Radiators of 1,000 pounds weight or over are liable to be strained or broken in transportation. It is recommended that customers order these large radiators shipped in halves.

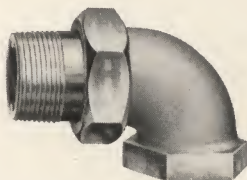
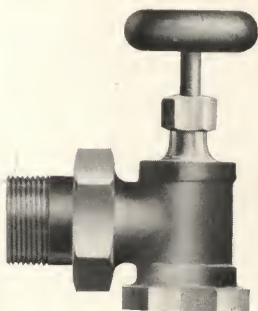
When ordering curved or corner radiators specify exact radius or angle of the base-board at floor within which the radiator is to be placed. Show by sketch which end of radiator is for supply connection and which for return, as you face the inside of curve or angle.

For convenience in handling, Indirect radiators will be shipped loose. Customer should be careful to specify the size of stacks into which sections are intended to be built, so that necessary supply and return sections may be shipped.

Without instructions all shipments are made by the shortest and quickest route known to us at released rates. When goods are receipted for by the Railroad Company our responsibility ceases. Claims for breakage or delay in transit must be made to Railroad Company.

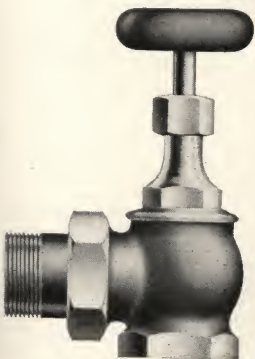
If for any reason customers desire to return goods they must first advise us and have the condition upon which the goods will be received agreed upon. This is necessary owing to the fact that all radiators returned must be re-tested and the sizes invariably changed—involving quite an item of expense.

## Quick-Opening Water Radiator Valves and Union Ells



Size, Inches.....	1/2	3/4	1	1 1/4	1 1/2	2
Price List Hot Water Valves, Rough Body, Plated All Over.....	\$2.40	\$2.85	\$3.65	\$5.05	\$7.10	\$10.85
Price List Union Elbows, Rough Body, Plated All Over.....	1.75	2.00	2.50	3.20	4.00	7.00

## Angle Steam Radiator Valves With Union and Jenkins Disc



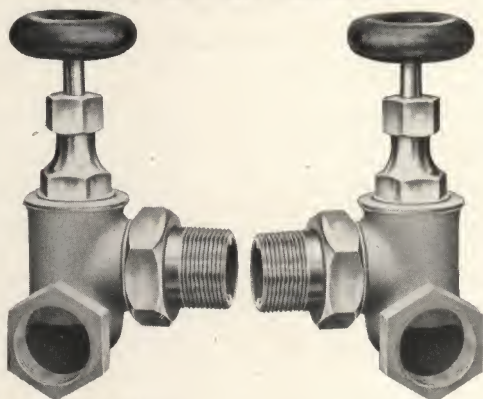
### Price List

Size, Inches.....	1 1/2	3/4	1	1 1/4	1 1/2	2
Angle Valves Rough Body, Plated All Over.....	\$3.15	\$3.80	\$4.75	\$6.40	\$8.10	\$13.10

Roughing-in measurements, pages 112 and 113.

## Corner Steam Radiator Valves

With Union and Jenkins Disc



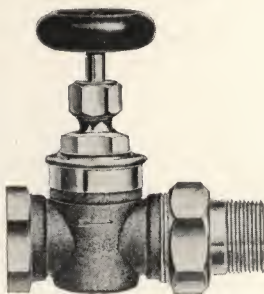
Right-Hand Valve

Left-Hand Valve

### Price List

Size, Inches.....	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2
Corner Valves, Rough Body, Plated All Over..	\$4.20	\$5.25	\$7.05	\$8.95	\$14.45

## Straightway Quick-Opening Hot Water Radiator Valves



### With Union

Size, Inches.....	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2
Price List, Rough Body, Plated All Over ..	\$2.85	\$3.65	\$5.05	\$7.10	\$10.85

Roughing-in measurements, pages 112 and 113.

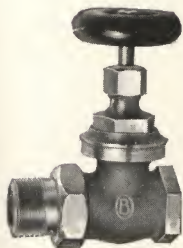


## W. W. Brass Gate Valves

Double Gate, Screwed,  
without Union

Price List, Rough Body, Plated All Over

$\frac{1}{2}$ inch.....	\$2.40
$\frac{3}{4}$ inch.....	3.00
1 inch.....	3.85
$1\frac{1}{4}$ inches.....	5.00
$1\frac{1}{2}$ inches.....	6.60
2 inches.....	9.65

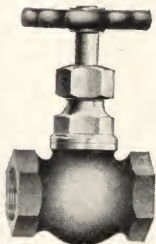


## W. W. Brass Gate Valves

Double Gate, Screwed, with Union

Price List, Rough Body, Plated All Over

$\frac{1}{2}$ inch.....	\$ 3.65
$\frac{3}{4}$ inch.....	4.25
1 inch.....	5.20
$1\frac{1}{4}$ inches.....	6.60
$1\frac{1}{2}$ inches.....	9.00
2 inches.....	12.80



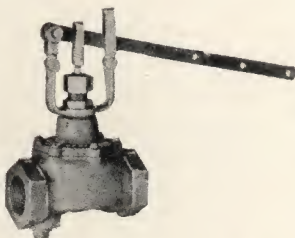
## Screw-Stem Globe Valves

Brass, Rough Body, Plated All Over

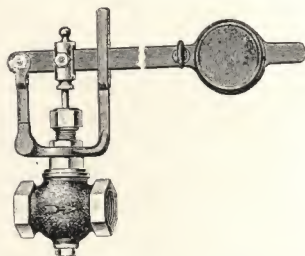
$\frac{1}{2}$ inch.....	\$ 1.00
$\frac{3}{4}$ inch.....	1.26
1 inch.....	1.80
$1\frac{1}{4}$ inches.....	2.52
$1\frac{1}{2}$ inches.....	3.50
2 inches.....	5.30
$2\frac{1}{2}$ inches.....	10.00
3 inches.....	14.40

Roughing-in measurements, pages 112 and 113.

## Regulating Valves



Made for Use on  
Natural Gas



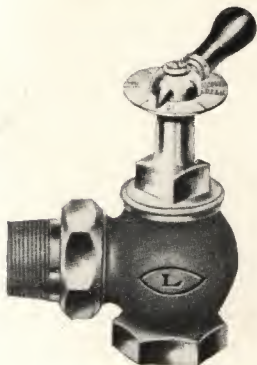
Made for Use on Street,  
Steam and Gas

### List Prices and Sizes of Valves for Street, Steam and Natural Gas High Pressure Steam Valves

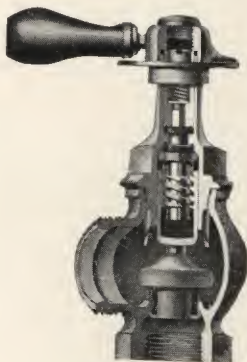
Size	Price
$\frac{1}{2}$ inch.....	\$ 5.50
$\frac{3}{4}$ inch.....	5.50
1 inch.....	6.00
$1\frac{1}{4}$ inches.....	7.25
$1\frac{1}{2}$ inches.....	9.00
2 inches.....	15.00
$2\frac{1}{2}$ inches.....	21.00
3 inches.....	34.00
$3\frac{1}{2}$ inches.....	50.00
4 inches.....	65.00
$3\frac{1}{2}$ inch Iron Body.....	40.00
4 inch Iron Body.....	50.00



## Novus Graduated Packless Valves



Graduated Type



Sectional View

Our Graduated Valve has a double adjustment by means of which each valve can be accurately adjusted to a wide range of sizes of radiators. With each valve we furnish 4 shells, any one of which may be attached to the disc-holder below the disc. The first shell has 1 upright slot, of the same height as the lift of the valve; the second shell has 2 such slots; the third shell has 3 such slots, and the fourth shell has 4 such slots. If the valve is to be connected to a very small radiator the shell with single slot should be used, while if the radiator is of medium or large size, a shell with 2, 3 or 4 slots should be employed.

It will be noticed that the amount of steam which can pass through the valve, when it is fully opened, will be the quantity that can pass through 1, 2, 3 or 4 slots, according to the shell employed below the disc. The steam fitter will attach such shell as will properly heat the whole radiator when the valve is fully opened. It follows that since the valve when fully opened will heat the whole radiator, when it is  $\frac{1}{4}$  open, as indicated by the graduated plate, it will heat  $\frac{1}{4}$  of the radiator; when it is  $\frac{1}{2}$  open, it will heat  $\frac{1}{2}$  of the radiator; when it is  $\frac{3}{4}$  open, it will heat  $\frac{3}{4}$  of the radiator, etc., etc. It will also be noticed that in addition to the markings,  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$  and open, the space between each pair of these is divided in two by another mark, thus dividing the graduated arc into eighths. The indicator can be placed midway between these latter markings, thus graduating by sixteenths. You can, therefore, heat whatever fraction of the radiator you may desire.

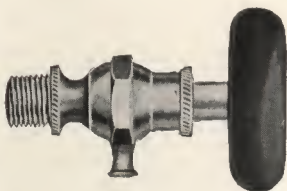
Novus Packless Valves are made in angle and in right-hand and left-hand corner styles. We also furnish them with wood wheels, lever handles or with lock shields. The graduated valves are also furnished with lever handle indicator or with lock shield, as may be preferred.

### Price List

	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2
Graduated Angle Packless Valves, Lever Handle or Lock Shield Styles With Shells.....	\$3.80	\$4.50	\$5.50	\$7.25	\$9.00	\$14.30
Without Shells.....	3.65	4.30	5.25	7.00	8.65	13.90

Unless otherwise specified, Graduated Valves will be shipped with shells.

## Air Valves



Wood Wheel Valve



Key Valve

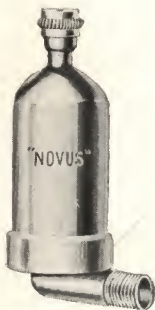
$\frac{1}{8}$  inch, each . . . . . \$0.70       $\frac{1}{8}$  inch, each . . . . . \$0.65

Extra Keys, 10 cents net.

Key and Wood Wheel air valves are of the best workmanship and finish. The threads are tapped with care and precision and are tapered, insuring perfectly tight joints.

The Novus Automatic Air Valve is the best competition valve on the market. The composition carbon is the best made and is drilled through the center, permitting the passing of a metal pin through this opening. This pin holds the carbon in position and prevents buckling. This valve will free the radiator of all air and prevent water escaping.

List Price . . . . . \$1.25



# The Solus Perfect Automatic Air Valve



**Solus Perfect Valve**

Automatic air valves are indispensable factors in a heating plant and play such an important part that the use of cheaply made air valves are a serious menace to the steam fitter as well as to the owner.



**Inside View**

If you are interested in a good reliable automatic air valve, a careful consideration of the following will prove to you that there can be had a reliable air valve at a reasonable price.

The above cuts give a clear insight into the mechanical construction of this valve. It is made to wear and there are no perishable or intricate parts to get out of order.



**Inside View  
With Vacuum Attachment**

No automatic air valve now on the market has given as good results under continuous usage.

It is manufactured from an excellent quality of steam metal and all parts finished on a lathe to insure clean waterways.



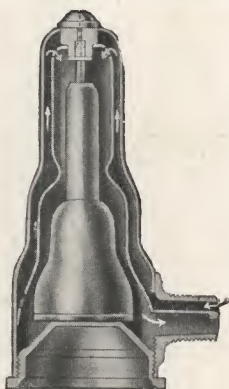
**Lock Shield Valve**

**These valves are guaranteed for five years.**

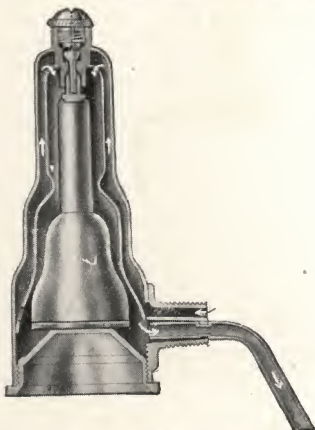
Any conditions arising which are not covered by this description, write us and we will gladly endeavor to give you the information necessary.

Solus Perfect Automatic Air Valve, list price each.....	\$1.15
Solus Perfect Automatic Air and Vacuum Valve, list price each.....	2.00

## "Novus" Siphon Air and Vacuum Valve



**Novus Non-Adjustable  
Automatic Air Valve  
with or without Siphon**



**Novus Non-Adjustable  
Siphon, Automatic Air  
and Vacuum Valve**

### Non-Adjustable

The valve is made entirely of best steam metal and phosphor bronze.

Vents to the last molecule of air and keeps it out after being expelled.

It is absolutely automatic and mechanically perfect.

It can be easily taken apart and cleaned should the occasion arise, making it as good as new.

The opening of windows and doors does not in any way affect its proper function.

It operates on the fraction of an ounce pressure. It closes against the loss of steam, the loss of water and the return of air.

It saves coal and maintains the efficiency of every section of the radiator—the last as well as the first.

Full efficiency, guaranteed five years.

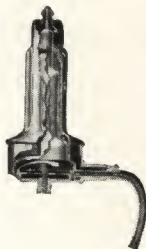
### List Prices

Novus Non-Adjustable Automatic Air Valve, each. . . . . \$1.50

Novus Non-Adjustable Siphon Air and Vacuum Valve, ea. 3.00



# NATIONAL HEATING SPECIALTIES



No. 1

The No. 1 Hoffman Siphon Air Valve is made for the perfect venting of air in steam radiators. It has no expansion post, is non-adjustable and operatively perfect.

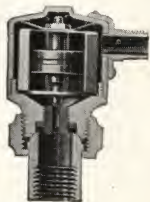
List price, each.....\$1.90



No. 2

The No. 2 Hoffman Siphon Air and Vacuum Valve is absolutely automatic and requires no adjustment at any time. It is air, steam and water tight and functions perfectly.

List price, each.....\$4.50



No. 3

The No. 3 Hoffman "Air Line" Valve is for drip or vacuum. It vents the last vestige of air but automatically closes against steam.

List price, each.....\$2.50

The No. 4 Hoffman Junior Quick Vent Air Valve is automatic and non-adjustable. It is a dependable valve and keeps mains and risers free from air. It does not close against water.

List price, each.....\$2.80

The No. 5 Hoffman Quick Vent Float Air Valve is a perfect venting device for blast coils or vent stacks. It is open for air passage but closed tight against steam or water.

List price, each.....\$8.00



No. 6

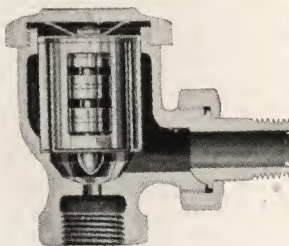
The No. 6 Hoffman Quick Vent Float Air and Vacuum Valve is intended for quick vent vacuum service. It is a vent valve which positively closes against steam and water and the return of air. It is designed for vapor, vacuum, modulating and gravity vacuum systems.

List price, each.....\$12.00



## Hoffman Return Line Valve

The Hoffman Return Line Valve is an efficient, reliable and dependable radiator trap; a thermostatic valve that is absolutely automatic and non-adjustable and operative under vacuum or plus pressures without any change or adjustment whatever.

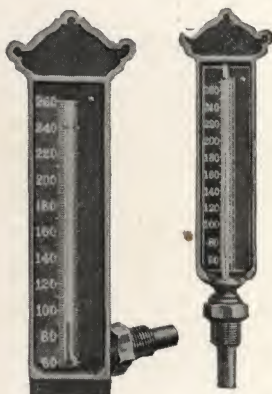


No. 8

This valve **freely passes all air and water but closes tight against steam.** Guaranteed for five years. Made in the following sizes:

- |  |        |
|--|--------|
| No. 8 Hoffman Return Line Valve,                             |        |
| ½ inch angle connection, list price                          | \$6.00 |
| No. 8 Hoffman Return Line Valve,                             |        |
| ½ inch right-hand offset connection, list price              | 6.00   |
| No. 8 Hoffman Return Line Valve,                             |        |
| ½ inch left-hand offset connection, list price               | 6.00   |
| No. 8 Hoffman Return Line Valve,                             |        |
| ½ inch angle straightway connection, list price              | 6.00   |
| No. 9 Return Line Valve, ¾ inch angle connection, list price | 8.00   |

## Hot Water Thermometers

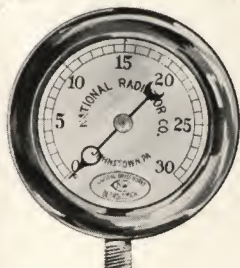


Angle or Straight

List Price Each

- |  |        |
|--|--------|
| Hot Water Thermometer, straight                                | \$5.00 |
| Hot Water Thermometer (for use on risers, or circulating pipe) | 6.00   |

## Novus Steam Gauges



This gauge is of the Bourbon single spring type and is constructed so as to prevent the corrosion of the moving parts. It is especially adapted for use in cellars, basements, etc. All markings on the dial are large and plain, making it easy to read the gauge. Size,  $3\frac{1}{2}$  inches. We supply high pressure gauges and will name prices upon application.

List Price, each . . . . . \$8.20

## Novus Altitude Gauges

This gauge is used in connection with hot water heaters and registers the height of the column of water in the system. The black hand is connected with the working parts of the gauge and denotes on the dial the height of the water in the system. After the system is filled to the proper height, the red hand is set at the point that the black hand registers. This red hand being stationary thus serves to show the height of water necessary to fill the system.



List Price, each . . . . . \$12.20

## Novus Floor and Ceiling Plates



**Planished Steel Hinged Adjustable Floor and Ceiling Plates**

A heavy stamped steel adjustable floor and ceiling plate; handsome in design and substantially constructed.

It is held firmly to the pipe by four jaws, stamped to conform to the pipe.

The plate cannot be equalled in finish by any plate on the market; it is nickeled on copper and highly polished.

### List Prices

Size, Inches..	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3
Black.....	\$0.14	\$0.14	\$0.15	\$0.16	\$0.17	\$0.20	\$0.22	\$0.25	\$0.30	\$0.50	\$0.65
Nickeled....	.25	.25	.26	.27	.28	.32	.35	.38	.45	.65	.80

## Novus Spud Wrench



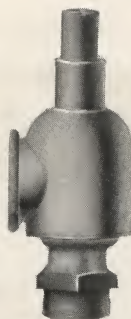
This is a handy tool to have in any fitter's kit. It will fit 2-inch,  $1\frac{1}{2}$ -inch,  $1\frac{1}{4}$ -inch, 1-inch and  $\frac{3}{4}$ -inch spuds.

List Price, each. ....\$0.60

# NATIONAL HEATING SPECIALTIES



**Novus Pop Safety Valve**  
Low Pressure



**Novus Water Relief Valve**

## List Price, Pop Safety Valves

Size, Inches. . . . .	1	1¼	1½	2	2½	3	3½	4
Price, each . . . . .	\$6.00	\$6.75	\$8.25	\$11.75	\$26.00	\$37.50	\$50.00	\$80.00

## List Price, Water Relief Valves

Size, Inches. . . . .	1	1¼	1½	2	2½	3	3½	4
Price, each . . . . .	\$12.00	\$15.00	\$18.00	\$27.00	\$43.00	\$72.00	\$95.00	\$120.00

## Brass Water Gauges

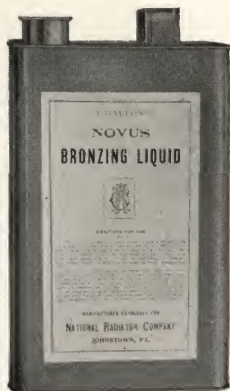
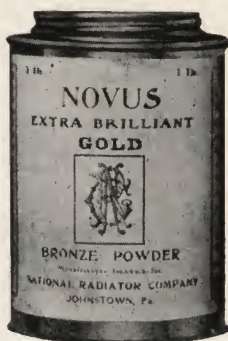
Self-Cleaning



Size, ½" Gauge Glass, ⅝ x 12  
List Price . . . . . \$2.60

Size, ½" Gauge Glass, ⅝ x 12  
List Price . . . . . \$3.00

## Bronze and Bronzing Liquid



We wish to call the attention of the fitters to our line of bronze and bronzing liquid. We have secured the agency for a line of bronzes which is unsurpassed by any other sold.

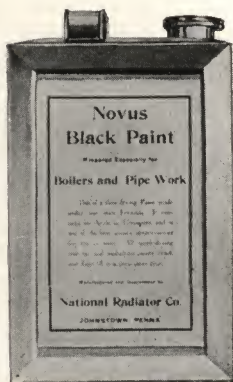
One trial of these bronzes will be sufficient to prove the worth of these goods. They are fully guaranteed.

Colors — Pale gold, rich gold, copper, green and aluminum in one-pound cans; and aluminum in half-pound cans.

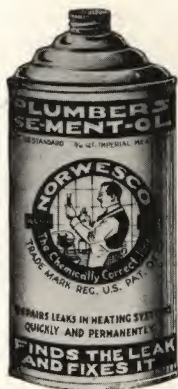
Bronzing liquid in gallon and half-gallon patent-stoppered cans.

## Novus Black Asphaltum

For the painting of boilers and cellar pipes, we furnish our special grade of Black Asphaltum, in one-gallon cans. This is a slow drying paint and will not crack or flake off like the cheaper grades. This will give perfect satisfaction.







Sementol



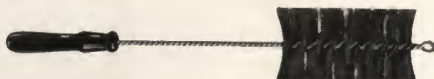
Shur-tite

Sementol is a liquid chemical compound which can conveniently be introduced into the water in the boiler, a radiator or piping and will very quickly close any leaks. It has been used with success on thousands of installations and has saved the fitter and property owner thousands of dollars on repairs. The can is so constructed that it is most convenient to use, every drop it contains can be used without spilling.

Shur-tite is a powder chemically of such a character that it will stop leaks immediately in the boiler, radiator or piping. It is soluble and can be used either in powder or liquid form. As a powder it is most convenient for the fitter. It is a compound of unusual strength and will close leaks permanently, making the broken casting as good as new. The results obtained from its use are really marvelous.

Prices quoted upon application.

## Radiator Brush



This brush has been designed especially for cleaning dust from surface of radiators, that could not otherwise be reached.

## Bronze Brushes



We carry in stock a full line of high grade brushes.

## Novus Boiler Brushes



Round	1904	Export	Oval
2", 2½", 3", 4"	4½"x4"x1¾"	6"x4½"x2¾"	2¾"x4"x1"

When ordering flue brushes, in all cases show on order size and style of boiler for which they are intended.

Steam  
Traps  
Empire  
Pattern



Sizes, Capacities and Prices

Number . . . . .	0	1	2	3
Weight, pounds . . . . .	30	59	72	117
Inlet connection, inches . . . . .	1	1 1/4	1 1/2	2
Outlet connection, inches . . . . .	3/4	1	1 1/4	1 1/2
Drainage capacity, lineal feet of 1-inch pipe . . . . .	1,500	3,600	5,700	12,000
Drainage capacity, square feet of direct radiating surface . . . . .	500	1,200	1,900	4,000
Price, without automatic air valve . . . . .	\$23.00	\$30.00	\$40.00	\$60.00
Price, with automatic air valve . . . . .	25.00	32.00	42.00	62.00

The above capacities are based on a condensation equal to 33 1/3 pound of water per hour per square foot of radiation, operating under low pressure.

These traps, as regularly made, are for low pressure and should not be used where the pressure exceeds 10 pounds to the square inch.

The copper balls used in these traps are of the finest material and workmanship and are tested at 150 pounds pressure, and guaranteed not to leak or collapse under 75 pounds pressure.

The valve stems operate through guides, thus preventing any possibility of becoming unseated.

Rules for Setting and Operating

After trap is set in level position, remove long 3/8-inch plug from top, and replace plug by a long automatic air valve, and trap is ready for operation.

Where trap is used in connection with economizing coil, place trap above coil.

This trap has large outlet opening, and is intended to be used only where it is subject to not more than 10 pounds pressure.

## Expansion Tanks

### Galvanized Steel



These tanks are made of refined boiler steel, double-riveted, caulked and galvanized, and tested to 150 pounds pressure.

They are tapped top and bottom for 1-inch overflow and expansion pipe, and on the side near the top; 1 inch for filling attachment.

They are also tapped on side for  $\frac{1}{2}$ -inch water gauge brasses. For price list, see page 77.

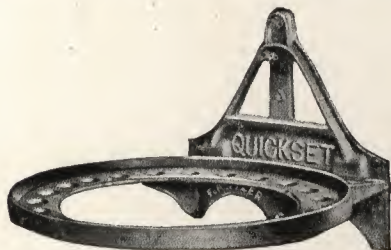
## Galvanized Expansion Tanks

### Price List

Capacity Gallons	Size Inches	Square Feet of Radiation	Price
8	10 x 20	250	\$ 7.50
10	12 x 20	300	8.00
15	12 x 30	500	9.00
20	14 x 30	700	12.50
26	16 x 30	950	14.00
32	16 x 36	1300	15.00
42	16 x 48	2000	16.50
66	18 x 60	3000	31.00
82	20 x 60	5000	37.00
100	22 x 60	6000	51.00

Prices do not include water gauges.

## Quickset Expansion Tank Shelf



### List Prices

No. 1.	10-inch, for 8 gallon Tank.....	\$2.30
No. 2.	12-inch, for 10-18 gallon Tank.....	2.50
No. 3.	14-inch, for 20-24 gallon Tank.....	2.80
No. 50.	16-inch, for 26-42 gallon Tank.....	5.30



## Storage Tanks



Vertical or horizontal, with or without coil. All standard storage tanks are tested to a hydrostatic pressure of 100 pounds to the square inch and are guaranteed for a working pressure of 65 pounds per square inch.

All extra heavy storage tanks are tested to a hydrostatic pressure of 150 lbs. to the square inch, and are guaranteed for a working pressure 100 lbs. to the square inch. All longitudinal seams double-riveted. All heads dished.

Cut shows regular stock tank. Tappings are arranged so tanks can be used either vertically or horizontally, by plugging openings not needed. All tanks 24 inches by 6 feet and smaller have 1½-inch tappings; all larger sizes have 2-inch tappings, except extra heavy storage tanks, 48-inch and larger, which have 3-inch tappings.

Storage tanks are furnished, when ordered, with flanged openings, manholes and handholes.

Orders for special tanks, including galvanized tanks, tanks with coils, manholes, etc., cannot be cancelled after work has been started.

Prices quoted upon application.

## Standard Hot Water Storage Tanks

Capacity Gallons	Size Inches Feet	Weight Pounds	Size Openings Inches	Size Coil 4 Pipes Inches
66	20 x 4	225	1½	1
85	20 x 5	260	1½	1
100	24 x 4	280	1½	1¼
120	24 x 5	325	1½	1¼
140	24 x 6	360	1½	1¼
150	30 x 4	375	2	1¼
180	30 x 5	450	2	1¼
220	30 x 6	500	2	1¼
250	30 x 7	560	2	1¼
295	30 x 8	625	2	1¼
315	36 x 6	670	2	1½
365	36 x 7	750	2	1½
420	36 x 8	825	2	1½
525	36 x 10	980	2	1½
430	42 x 6	850	2	1½
500	42 x 7	955	2	1½
575	42 x 8	1050	2	1½
720	42 x 10	1210	2	1½
865	42 x 12	1380	2	1½
1000	42 x 14	1575	2	1½

## Extra Heavy Hot Water Storage Tanks

Capacity Gallons	Size Inches Feet	Weight Pounds	Size Openings Inches
120	24 x 5	370	1½
140	24 x 6	425	1½
180	30 x 5	530	2
220	30 x 6	600	2
250	30 x 7	670	2
295	30 x 8	720	2
315	36 x 6	940	2
365	36 x 7	1060	2
420	36 x 8	1150	2
525	36 x 10	1375	2
430	42 x 6	1200	2
500	42 x 7	1325	2
575	42 x 8	1425	2
720	42 x 10	1685	2
865	42 x 12	1920	2
1000	42 x 14	2160	2
750	48 x 8	1760	3
940	48 x 10	2000	3
1130	48 x 12	2280	3
1300	48 x 14	2550	3

Prices quoted upon application.

## Honeywell Water Regulator



A simple and positive instrument for regulating the temperature of water in a hot water heating system or storage tank. It has a temperature range of from 120 to 220 degrees and will keep the water in the system at any degree between these temperatures. When properly connected it will open and close the dampers within a water temperature change of two or three degrees. The Regulator is 10 inches in height, 5 inches from bottom of bulb to top of threads and 5 inches from the latter point to the top of regulator. The neck is threaded for 1½-inch pipe opening.

With each Regulator are furnished chains and pulleys, a lever three feet in length, and two ball weights.

When used for controlling the temperature of water in storage tanks where water is heated by a tank heater, the regulator may be connected into one of the tappings on the top of the heater, if convenient, and the weights so placed on the lever, that any temperature may be maintained in the tank, as long as there is fire in the heater.

Especially suitable for regulating the temperature of water in greenhouse heating plants.

No. 3 Honeywell Water Regulator, list. .... \$20.00

## The Honeywell Vapor Relief



The Honeywell Vapor Relief is designed and constructed to be placed on atmospheric vapor heating boilers.

This extremely simple and inexpensive device contains no valves or mechanical parts of any kind — just three open tubes through which vapor and water circulate when the relief is operating. It is made entirely of cast iron in two parts and will last indefinitely.

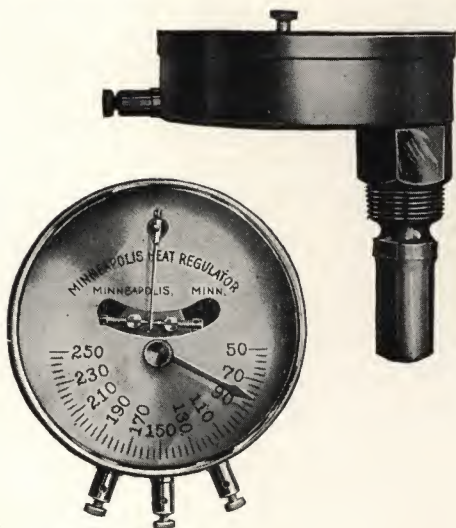
With the Honeywell Vapor Relief properly installed it is unnecessary to place check valves in the return mains near the boiler to prevent water from backing out under pressure, as the Honeywell Vapor Relief will relieve the pressure at twelve ounces without any possibility of sticking.



### List Prices

Honeywell Vapor Regulator for any size boiler. ....	\$45.00
Honeywell Vapor Relief, 1¼ inches for 1200 sq. ft. or less. ....	8.00
Height, 31 inches	
Honeywell Vapor Relief, 2 inches for over 1200 sq. ft. ....	12.00
Height, 31 inches	

## Minneapolis Tank Regulators



This device has the same electrical construction and is regulated in the same manner as the Minneapolis Heat Regulator — the only difference being in the extension.

In connection with the motor, it controls valves, dampers, etc., for the regulation of hot water, steam, bake ovens, vulcanizers, etc.

The extension is put through the side of boiler or other receptacle and firmly fastened into place by the screw thread, thereby making a perfectly tight joint, having the case and dial outside.

This regulator is used extensively in apartments, hospitals, public buildings, or any place where hot water is required throughout the year. Prevents water boiling and is a fuel saver. If necessary can be made to a range of 400 degrees Fahrenheit.

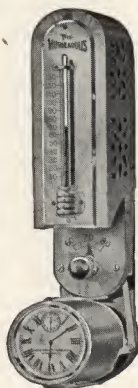
Size of thermostat, 4 inches. Length of extension, 2 inches. If longer extension is required, it can be furnished at an additional charge.

List prices, see page 83.

**Important Note:**—Order by Model number and if Electric, specify D. C. or A. C. Our A. C. Motors are 110 volts, 60 cycle.



## The Minneapolis Heat Regulator



Model No. 47  
One-Day Clock



Model No. 60  
Eight-Day Clock



Model No. 55  
Eight-Day Clock

## Time Attachments for Thermostat

Consists of reliable clocks mounted in connection with the Thermostat and of similar finish.

The Time Attachment will change point of temperature control at any pre-determined hour. With the Time Attachment the pointer of thermostat may be set to any lower degree and the alarm hand of clock set at any hour when you desire temperature changed. The pointer will at that hour automatically and silently move to 70; the thermostat being always in control and never "cut out."



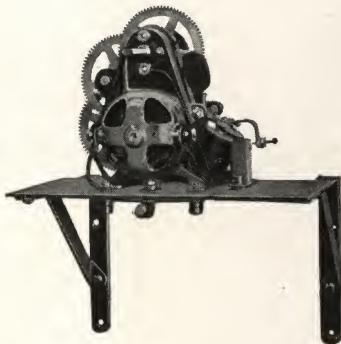
Gravity Motor Model



Spring Motor Model



Non-Wind Electric Motor



This motor is furnished for use with either direct or alternating current. It is the latest and most improved in design and can be operated directly from the house lighting circuit.

List Prices and Model Numbers

List Prices and Model Designation Thermostat Only

Model No.	Description	New List Prices
No. 40	Plain Thermostat—no clock.....	\$21.00
No. 47	One-day Clock Thermostat (39 and 47).....	28.00
No. 55	Eight-day Clock (Duplex) Thermostat.....	40.00
No. 60	Eight-day Clock (Square) Thermostat.....	50.00
No. 65	Hot Water Tank or Boiler Thermostat.....	45.00

List Prices.— Motors Only

Designation	Description	
Gravity (G)	Gravity Motor—Weight Power.....	\$16.00
Spring (S)	Spring Motor—Spring Power.....	24.00
D. C.	6-Volt. Operating on 4 Dry Cells Only.....	39.00
A. C.	110-Volt, 60 Cycle, Alternating Current.....	49.00
110 D. C.	110-Volt, D. C. Motor and 2 Dry Cell Thermostat Circuit.....	49.00

List Prices Complete Regulators

Model No.	Motor Equipment†	Gravity	Spring	A. C.	D. C.	110 D. C.
No. 40	(Plain Thermostat, no Clock)	\$37.00	\$45.00	\$70.00	\$60.00	\$70.00
No. 47	(One-day Thermostat).....	44.00	52.00	77.00	67.00	77.00
No. 55	(Eight-day Duplex).....	56.00	64.00	89.00	79.00	89.00
No. 60	(Eight-day Square Clock) . .	66.00	74.00	99.00	89.00	99.00
No. 65	(Hot Water Tank or Boiler	61.00	69.00	94.00	84.00	94.00

In ordering give model number and add motor designation.

## Novus Sectional Coverings

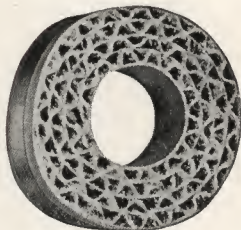


### Wool Felt Covering For Hot Water and Low-Pressure Steam Pipes

We furnish this covering in any thickness, with body of superior wool felt, which most steam fitters agree is the best non-conductor for low-pressure heating work. It is lined inside with asbestos paper and is of the highest standard of quality.

## Asbestos Air Cell Covering

For Hot Water and High and Low-Pressure Steam

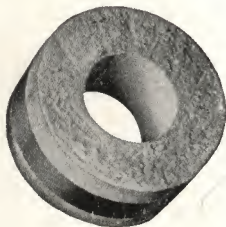


This covering is made of special corrugated paper. It is a recognized non-conductor, thoroughly fire-proof and almost indestructible. It is full quarter-inch and has small corrugations, leaving little space for confined air. It is light and easily applied and will not "pinch down" in working. One inch or four-ply is used for high-pressure, three-quarter inch or three-ply is used for low-pressure, and one-half inch or two-ply is used for hot water.

## Asbestos Magnesia Sectional Moulded Covering

For Steam Pipes and all  
High-Pressure Work

Where great strength and durability are required, this covering meets requirements admirably. The superiority of this covering is due to the excellent quality of all materials used and to the special process of construction. The composition includes fibre asbestos, carbonate of magnesia and other fire-proofing materials.



## Plastic Asbestos Boiler Cement

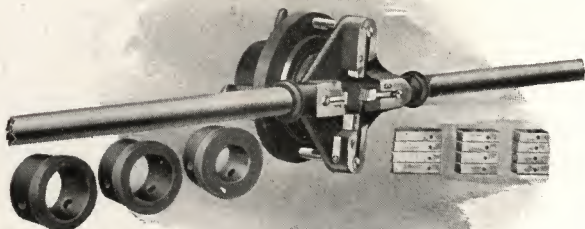
We are prepared to furnish a high grade of Plastic Asbestos Cement for covering boilers, etc. This is put up regularly in 100 pound bags.

## Standard Price List of Sectional Pipe Coverings and Fittings

Size Inside Diameter Inches	Coverings in Lineal Feet	Ells Each	Tees Each	Crosses Each	Valves Each
$\frac{1}{2}$	\$0.22	\$0.30	\$0.36	\$0.48	\$0.54
$\frac{3}{4}$	.24	.30	.36	.48	.54
1	.27	.30	.36	.48	.54
$1\frac{1}{4}$	.30	.30	.36	.48	.54
$1\frac{1}{2}$	.33	.30	.36	.48	.54
2	.36	.36	.42	.54	.60
$2\frac{1}{2}$	.40	.42	.48	.60	.78
3	.45	.48	.54	.70	.96
$3\frac{1}{2}$	.50	.54	.60	.80	1.20
4	.60	.60	.75	.95	1.50
$4\frac{1}{2}$	.65	.72	.90	1.10	1.85
5	.70	.90	1.20	1.50	2.25
6	.80	1.30	1.60	2.00	2.80
7	1.00	1.80	2.20	2.80	3.60
8	1.10	2.40	3.00	3.60	4.40
9	1.20	3.00	3.80	4.40	5.30
10	1.30	3.60	4.60	5.20	6.20
12	1.85	....	....	....	....

In order to prevent confusion we have but one price list for our different kinds of coverings up to and including one inch in thickness.

## The Toledo Pipe-Threading Devices



Adjustable Threader No. 1

### Adjustable Threading Devices

The receding die feature of these tools is the secret of their easy operation. The dies recede against taper pins in all but two tools. In the Nos. 0 and 10 the dies recede against a series of tapered steps. With a No. 1 machine one man can thread 2-inch pipe easily with one hand. With the larger sizes, Nos. 2, 3 and 4, which are geared, one man can thread up to 12-inch pipe.

No. 1-A is the same as No. 1, with a ratchet attachment. Nos. 2, 3 and 4 have ratchet handle. With these tools it is possible to thread pipe in corners and close places where ordinary tools cannot be operated.

### List Prices Complete with Dies

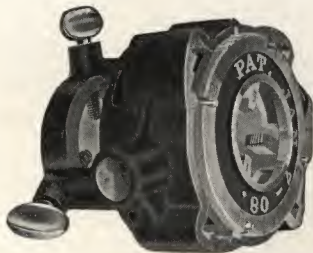
No. 1, Capacity 1 to 2-inch pipe, inclusive (shipping weight 25 lbs.) each.....	\$ 24.00
No. 1-A, Capacity 1 to 2-inch pipe, inclusive, with Ratchet (shipping weight 25 lbs.) each.....	30.00
No. 2, geared, Capacity 2½ to 4-inch pipe, inclusive (shipping weight 100 lbs.) each.....	100.00
No. 3 geared, Capacity 4½ to 8-inch pipe, inclusive (shipping weight 200 lbs.) each.....	300.00
No. 4, geared, Capacity 9 to 12-inch pipe, inclusive (shipping weight 300 lbs.) each.....	500.00

### List Prices of Extra Dies

No. 1 or No. 1-A, Complete Set.....	\$10.00
No. 1 or No. 1-A, Single Set.....	2.50
No. 2, Complete Set.....	32.00
Single Set.....	8.00
No. 3, Complete Set.....	60.00
Single Set.....	12.00
No. 4, Complete Set.....	60.00
Single Set.....	20.00



The Toledo Pipe-Threading Devices



Adjustable Threader No. 10

These tools are adjustable for threading several sizes of pipe with one set of dies. They are different from ordinary adjustable die stocks in that they have no cam or intricate mechanism to become clogged with chips. Extra long taper may be secured with the No. 10 machine. Left-hand dies can be furnished for the Nos. 0 and 10, but one set will only thread one size of pipe, necessitating for instance four sets to complete left-hand equipment for the No. 10. Two sets of dies are furnished with the No. 25, so that when one set is being reground another set will take its place. No bushings are supplied for these tools as they are equipped with "Toledo" micrometer thumb screws, which enable the operator to center the tool on the pipe without bushings.

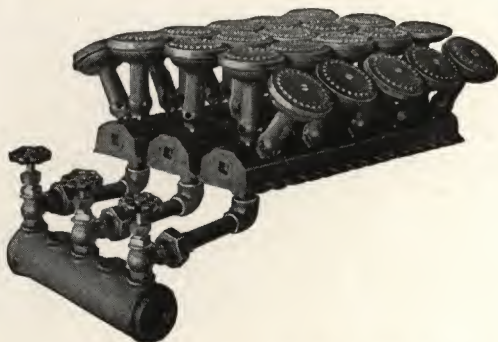
List Prices Complete with Dies

No. 0, Capacity, 1/8 to 3/4-inch pipe, inclusive (shipping weight 10 lbs.) each.....	\$ 16.00
No. 10, Capacity 1 to 2-inch pipe, inclusive (shipping weight 25 lbs.) each.....	28.00
No. 10-A, same as No. 10, but with Ratchet (shipping weight 25 lbs.) each.....	34.00
No. 25, geared, Capacity, 2 1/2 to 6-inch pipe, inclusive (shipping weight 150 lbs.) each.....	230.00

List Price of Extra Dies

No. 0, Complete Set Right Hand.....	\$ 7.50
No. 0, Single Set Right Hand.....	2.50
No. 0, Single Set Left Hand.....	2.50
No. 10 or 10-A, Set Right Hand.....	2.75
No. 10 or 10-A, Complete Set Left Hand.....	11.00
No. 10 or 10-A, Single Set Left Hand.....	2.75
No. 25, Set Right Hand.....	8.00





### Gas Burner and Manifold for Square Firepots

Novus Gas Burners have been designed for boilers having either a round or square firepot. The various combinations of burners worked out for each size of boiler provide the most effective and economical gas-burning device that can be used in either a steam or hot-water boiler.



### Gas Burner for Round Firepots

The arrangement of these burners for each size of a boiler gives a complete and effective way of controlling the gas, thus insuring economy in gas consumption and to suit weather conditions.

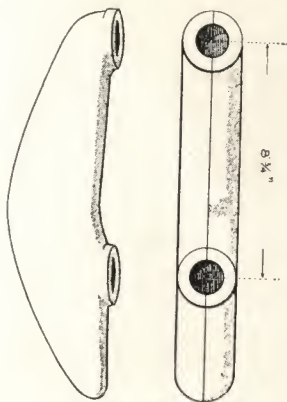
Novus Gas Burners are mounted complete with Air Mixers and Orifice Spuds and are easy to install. To do the work, all that is necessary is to lay the burners on the top of the grate bars and make the connection down through the grate bars and out through the ash-pit door. When a header is necessary these connections are made to the valves attached to the header outside of the ash-pit door.

## Gas Burners

### Steam and Hot Water Boilers List Prices

Series	Sections	List Price	Series	Sections	List Price
20-Inch	5	\$25.30	36-Inch	9	\$124.70
"	6	28.30	48-Inch	6	134.60
"	7	34.80	"	7	160.80
25-Inch	5	46.90	"	8	190.00
"	6	58.70	"	9	199.80
"	7	69.50	"	10	199.80
"	8	79.30	30 Novus	..	12.80
31-Inch	5	47.90	40 Novus	..	19.10
"	6	58.70	50 Novus	..	25.90
"	7	69.50	60 Novus	..	31.80
"	8	79.40	17 Round	..	7.10
36-Inch	5	67.10	19 Round	..	8.40
"	6	97.40	21 Round	..	20.20
"	7	111.00	25 Round	..	20.20
"	8	124.70	28 Round	..	25.00

## Novus Waterback, Upright Boilers

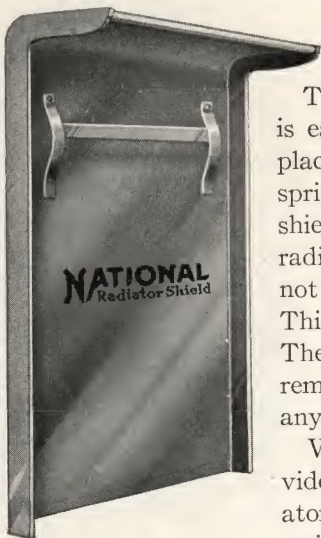


**T**HE Novus Waterback is a special device to be used in the firepot of Novus Upright Boilers for supplying hot water for domestic use. It is easier to install and more efficient than the ordinary pipe coil.

List Price.....\$6.00

## National Radiator Shield

Air in a room is attracted to the heated radiator. In its circulation upward from the radiator, minute particles of dust are deposited on the wall directly above the radiator. In time this makes an unsightly appearance. To do away with this discoloration of the wall, the National Improved Radiator Shield should be used.



The National Radiator Shield is easily and quickly put into place by anyone. The special spring attachment holds the shield securely between the radiator and the wall — and is not fastened to the radiator. This attachment is adjustable. The shield may be put on or removed with perfect ease by anyone.

Various metal finishes are provided, or both shield and radiator may be covered with a heat-resisting paint to harmonize with room decorations — making an inconspicuous radiator unit.

National Radiator Shields are moderate in price and the design is attractive.

Finishes: Made in plain steel, gold, copper, or aluminum, bronze, or black iron finish; antique copper finish.

## National Radiator Shields

### List Prices

No. Sections in Radiator 2½ Inch Centers	Plain Steel	Gold, Copper Aluminum Bronze or Black Iron Finish	Antique Copper Finish
8	\$ 9.80	\$11.20	\$14.00
9	10.25	11.75	14.70
10	10.70	12.30	15.40
11	11.15	12.85	16.10
12	11.60	13.40	16.80
13	12.05	13.95	17.50
14	12.50	14.50	18.20
15	12.95	15.05	18.90
16	13.40	15.60	19.60
17	13.85	16.15	20.30
18	14.30	16.70	21.00
19	14.75	17.25	21.70
20	15.20	17.80	22.40
21	15.65	18.35	23.10
22	16.10	18.90	23.80
23	16.55	19.45	24.50
24	17.00	20.00	25.20
25	21.20	25.55	32.40
26	21.65	26.10	33.10
27	22.10	26.65	33.80
28	22.55	27.20	34.50
29	23.00	27.75	35.20
30	23.45	28.30	35.90

All prices quoted include the cost of crating. List prices are based upon sections 2½ inches from center to center. When shields are to be used with other than National patterns, give name of manufacturer and distance from center to center of section.

All shields are supplied with our special equipment for installing. When radiators are placed more than 3 inches from wall it will be necessary to so advise in order that special equipment for installing may be supplied.



## The Royal Deflector

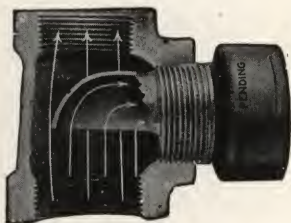
### For Hot Water Circulation

The accompanying cuts give a good idea of this fitting and its adaptability in controlling the circulation in a hot water heating system. The advantages of adjustment provide a variation in circulation which can be accomplished when the system is in operation.



This device is a fitting, by which an ordinary T may be converted into a special circulating fitting to control the circulation in a Hot Water heating system.

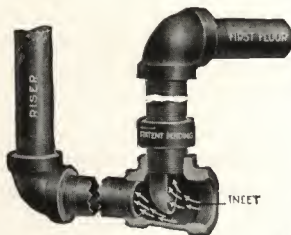
Means are provided on the hub to indicate the position of the deflecting end.



Sufficient clearance area is allowed to by-pass the deflector and fill the other branch.

Radiators can not reverse when the "Deflector" inlet faces the boiler in the flow and return.

Maximum deflection is essential on rising lines, and where a riser is taken off the end of a main near a first floor radiator, use "Deflector" in side outlet of T, one size less than inlet and bush to suit the branch.



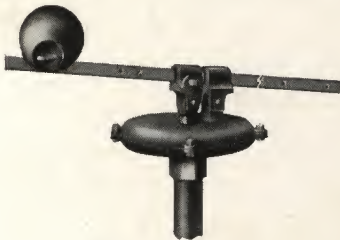
#### List Prices

$\frac{1}{2}$ inch Malleable... \$0.30	$1\frac{1}{4}$ inch Cast Iron... \$0.50
$\frac{3}{4}$ inch Malleable... .35	$1\frac{1}{2}$ inch Cast Iron... .60
1 inch Malleable... .40	$\frac{3}{4}$ inch sample by mail, .20



## Novus Sensitive All-Metal Damper Regulator

For Low-Pressure Steam



Patent Applied For

**Diaphragms are Made from Steam Metal**  
**Very Sensitive and Easy to Adjust**

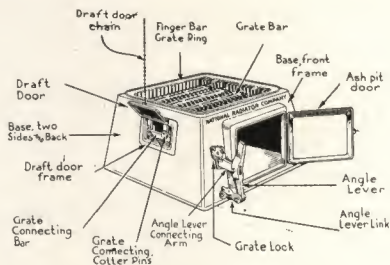
The Novus Sensitive All-Metal Damper Regulator is made entirely from the best of steam metals and is practically indestructible. The general arrangement of the diaphragms is such that it is very simple in construction and extremely sensitive. Tests have demonstrated that it will control drafts with unvarying precision from one ounce to any higher pressure desired and will last as long as the boiler.

This regulator should be connected to the opening provided for it on a steam boiler by means of a short nipple. This insures perfect operation.

To adjust this regulator, first connect the chains operating the draft doors as per standard practice. Then raise whatever pressure you desire to maintain at the boiler and set the weight accordingly on the regulating lever. Do not disconnect the chains from the doors in regulating pressure. This should be done by moving the weight on the regulating lever.

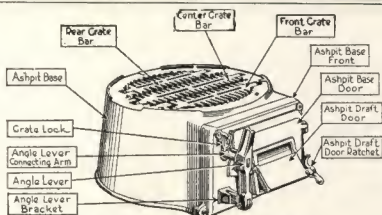
List Price . . . . . \$15.00

# NATIONAL PARTS, UPRIGHT BOILERS



Name of Part	Series of Boiler					
	10 or 100	20 or 200	30 or 300	40 or 400	50 or 500	60 or 600
Base (two sides and back) . . . . .	\$ 8.25	\$10.50	\$15.75	\$16.25	\$19.00	\$24.25
Base Front Frame (front only) . . . . .	2.50	2.50	4.75	4.75	6.25	6.25
Draft Door Ratchet . . . . .	.15	.15	.15	.15	.15	.15
Draft Door Frame . . . . .	.30	.30	.50	.50	.60	.60
Draft Door . . . . .	.30	.30	.50	.50	.60	.60
Ashpit Door . . . . .	.80	.80	1.75	1.75	2.50	2.50
Grate Lock . . . . .	.15	.15	.15	.15	.15	.15
Finger Bar Grate Ring . . . . .	3.00	3.50	7.50	9.00	10.00	11.50
Grate Bar . . . . .	1.20	1.20	2.25	2.25	3.00	3.00
Grate Connecting Bar . . . . .	.70	.90	.90	1.00	1.00	1.25
Angle Lever Connecting Arm . . . . .	.60	.60	.80	.80	.80	.80
Angle Lever . . . . .	.40	.40	.50	.50	.50	.50
Angle Lever Link . . . . .	.15	.15	.15	.15	.15	.15
Shaker Handle . . . . .	.80	.80	.80	.80	.80	.80
1st Firepot Section (bottom) . . . . .	15.00	17.00	25.00	32.00	40.00	44.00
2nd Firepot Section (middle) . . . . .	14.00	16.00	25.00	30.00	36.00	38.00
3rd Firepot Section (old top) . . . . .	14.00	16.00	26.00	34.00	41.00	48.00
3rd Firepot Section (new top) . . . . .	15.00	17.00	27.00	35.00	42.00	50.00
Center Section . . . . .	12.00	13.00	20.00	25.00	32.00	37.00
Steam Dome . . . . .	15.00	17.00	35.00	45.00	55.00	60.00
Water Dome . . . . .	12.00	14.00	22.00	30.00	38.00	44.00
Rear of Smoke Hood . . . . .	.50	.50	1.00	1.00	1.25	1.25
Front of Smoke Hood . . . . .	1.00	1.00	2.00	2.00	2.50	2.50
Check Draft Door Frame . . . . .	.20	.20	.50	.50	.60	.60
Check Draft Door . . . . .	.15	.15	.30	.30	.40	.40
Check Draft Door Ratchet . . . . .	.15	.15	.15	.15	.15	.15
Smoke Hood Damper . . . . .	.20	.20	.50	.50	.75	.75
Smoke Hood Damper Ring . . . . .	.30	.30	.50	.50	.60	.60
Smoke Hood Damper Handle . . . . .	.15	.15	.15	.15	.15	.15
Cleanout Door Frame . . . . .	.30	.30	.40	.40	.50	.50
Cleanout Door . . . . .	.20	.20	.25	.25	.40	.40
Fire Door Frame . . . . .	.80	.80	1.00	1.00	1.25	1.25
Fire Door . . . . .	.80	.80	1.50	1.50	2.00	2.00
Fire Door Lining . . . . .	.40	.40	.75	.75	1.00	1.00
Fire Door Draft Slide . . . . .	.15	.15	.25	.25	.25	.25
Clinker Door Frame . . . . .	.40	.40	.60	.60	.70	.70
Clinker Door . . . . .	.30	.30	.40	.40	.50	.50
Clinker Door Protecting Plate . . . . .	.25	.25	.30	.30	.40	.40
Door Handles (wire) . . . . .	.10	.10	.10	.10	.10	.10
Covers for coil openings (per pr.) . . . . .	.10	.10	.10	.10	.10	.10
Nipple . . . . .	.60	.60	1.00	1.00	1.50	1.50
Flue Brush . . . . .	.60	.60	.60	.60	.60	.60
Flue Brush Handle . . . . .	.75	.75	.75	.75	.75	.75
Poker . . . . .	.75	.75	.75	.75	.75	.75
Scraper . . . . .	.30	.30	.30	.30	.30	.30

# NATIONAL PARTS, NICO BOILERS



Note: Angle lever Connecting Arm connects to Grate Connecting Bar which connects grate bars inside of base

Name of Part	17"	19"	22"	25"
Firepot Section (closed).....	\$44.00	\$49.00	\$58.00	.....
Firepot Section (open).....	34.00	39.00	47.00	\$58.00
Crown Sheet Section.....	12.00	14.00	18.00	21.00
Double Water Top Section.....	21.00	26.00	35.00	45.00
Single Water Top Section.....	10.00	11.00	14.00	20.00
Double Steam Dome Section.....	26.00	29.00	39.00	57.00
Single Steam Dome Section.....	16.00	19.00	26.00	33.00
Section No. 1 (first above firepot).....	11.00	12.00	15.00	20.00
Section No. 2 (second above firepot)...	11.00	12.00	15.00	20.00
Base, Complete.....	20.00	22.00	26.00	30.00
Ashpit Base only.....	11.00	12.00	13.50	15.00
Ashpit Base Front.....	1.50	1.50	1.50	1.50
Ashpit Base Door.....	1.00	1.00	1.25	1.25
Ashpit Base Draft Door.....	.50	.50	.50	.50
Ashpit Base Draft Door Ratchet.....	.15	.15	.15	.15
Angle Lever.....	.75	.75	.75	.75
Angle Lever Bracket.....	.15	.15	.15	.15
Shaker Handle.....	.75	.75	.75	.75
Grate Bar, Front.....	1.00	1.25	1.25	1.50
Grate Bar, Back.....	1.00	1.25	1.25	1.50
Grate Bar, Center.....	1.50	1.75	.....	.....
Grate Bar, Front Center.....	.....	.....	1.75	2.25
Grate Bar, Back Center.....	.....	.....	1.75	2.25
Grate Connecting Bar.....	.30	.40	.50	.60
Angle Lever Connecting Arm.....	.30	.30	.30	.50
Grate Lock.....	.15	.15	.15	.15
Fire Door.....	1.00	1.00	1.25	1.25
Fire Door Frame.....	1.50	1.50	1.75	1.75
Fire Door Liner.....	.60	.60	.60	.60
Fire Door Slide.....	.25	.25	.25	.25
Fire Door Slide Knob.....	.15	.15	.15	.15
Cleanout Door.....	.30	.30	.30	.30
Cleanout Door Frame (top).....	.50	.50	.50	.50
Cleanout Door Frame (middle).....	.40	.40	.40	.40
Clinker Door.....	.30	.30	.30	.30
Clinker Door Frame.....	.40	.40	.50	.50
Outside Cover for Coil Opening.....	.15	.15	.15	.15
Inside Cover for Coil Opening.....	.15	.15	.15	.15
Smoke Hood for Back Outlet.....	1.75	1.75	1.75	1.75
Smoke Hood Turn Damper.....	.30	.30	.50	.50
Smoke Hood Check Draft Door.....	.30	.30	.30	.30
Smoke Hood Check Draft Door Frame.....	.30	.30	.30	.30
Smoke Hood Turn Damper Ratchet..	.15	.15	.15	.15
Smoke Elbow.....	1.75	1.75	1.75	1.75
Smoke Elbow Draft Door.....	.30	.30	.30	.30
Smoke Elbow Draft Door Frame.....	.30	.30	.30	.30
Smoke Elbow Draft Door Ratchet....	.15	.15	.15	.15
Smoke Elbow Turn Damper.....	.30	.30	.50	.50
Smoke Elbow Turn Damper Ratchet..	.15	.15	.15	.15
Turn Damper Handle.....	.15	.15	.15	.15
Flue Brush.....	.60	.60	.60	.60
Flue Brush Handle.....	.75	.75	.75	.75
Poker.....	.75	.75	.75	.75
Scraper.....	.30	.30	.30	.30
Nipples, each.....	3" .60	3" .60	4" .60	4" .60

# NATIONAL PARTS, RIVAL BOILERS

Name of Part	19"	22"	25"	28"	31"	34"
Firepot Section.....	\$54.00	\$72.00	\$77.00	\$94.00	\$100.00	\$128.00
Section No. 1 (first above firepot).....	15.00	22.00	27.00	35.00	38.00	42.00
Section No. 2 (second above firepot).....	15.00	22.00	27.00	35.00	38.00	42.00
Water Top Section.....	16.00	23.00	28.00	36.00	39.00	43.00
Steam Dome.....	35.00	42.00	49.00	70.00	73.00	82.00
Base Complete.....	35.00	40.00	48.00	63.00	68.00	90.00
Ashpit Base only.....	15.00	19.00	23.00	32.00	34.00	44.00
Ashpit Base Front.....	2.75	2.75	3.25	3.25	3.60	4.50
Ashpit Base Door.....	1.25	1.25	1.50	1.50	2.25	2.25
Ashpit Base Draft Door.....	.30	.30	.50	.50	.50	.50
Ashpit Base Draft Door Ratchet.....	.15	.15	.15	.15	.15	.15
Angle Lever Bracket.....	.30	.30	.30	.30	.30	.30
Angle Lever.....	.60	.60	.60	.60	.60	.60
Shaker Handle.....	.75	.75	.75	.75	.75	.75
Grate Bar Front.....	2.00	2.25	2.00	3.25	3.75	3.75
Grate Bar Back.....	2.00	2.25	2.00	3.25	3.75	3.75
Grate Bar Middle.....	2.25	3.25				
Grate Bar Back Center.....			3.00	4.25	5.25	7.00
Grate Bar Front Center.....			3.00	4.25	5.25	7.00
Grate Lock.....	.15	.15	.15	.15	.15	.15
Grate Ring.....	5.00	5.25	5.75	6.50	8.25	12.75
Grate Connecting Bar.....	.60	.75	.75	.90	1.00	1.25
Angle Lever Connecting Arm.....	.60	.60	.60	.60	.60	.60
Grate Pin.....	.15	.15	.15	.15	.15	.15
Grate Support, each.....	.15	.15	.15	.15	.15	.15
Fire Door.....	1.00	1.00	1.00	1.75	1.75	1.75
Fire Door Frame.....	2.00	2.00	2.50	2.75	2.75	2.75
Fire Door Liner.....	.60	.60	.60	.75	.75	.75
Fire Door Slide.....	.25	.25	.25	.25	.25	.25
Fire Door Slide Knob.....	.15	.15	.15	.15	.15	.15
Fire Door Handle (Old Style).....	.15	.15	.15	.15	.15	.15
Cleanout Door.....	.30	.30	.30	.30	.30	.30
Cleanout Door Frame.....	.60	.60	.60	.60	.60	.60
Cleanout Door Handle (Old Style).....	.15	.15	.15	.15	.15	.15
Clinker Door.....	.40	.40	.40	.50	.50	.50
Clinker Door Frame.....	1.00	1.00	1.00	1.25	1.25	1.25
Clinker Door Liner.....	.30	.30	.30	.30	.30	.30
Outside Cover for coil opening.....	.15	.15	.15	.15	.15	.15
Inside Cover for coil opening.....	.15	.15	.15	.15	.15	.15
Smoke Elbow.....	2.00	3.50	4.00	5.00	5.00	5.00
Smoke Elbow Check Draft Door.....	.30	.30	.30	.30	.30	.30
Smoke Elbow Check Draft Door Frame.....	.50	.50	.50	.75	.75	.75
Smoke Elbow Check Draft Door Ratchet.....	.15	.15	.15	.15	.15	.15
Smoke Elbow Turn Damper ..	.60	.60	.60	.75	.75	.75
Smoke Elbow Turn Damper Handle.....	.15	.15	.15	.15	.15	.15
Flue Brush.....	.60	.60	.60	.60	.60	.60
Flue Brush Handle.....	.75	.75	.75	.75	.75	.75
Poker.....	.75	.75	.75	.75	.75	.75
Scraper.....	.30	.30	.30	.30	.30	.30
Nipples, each.....	3" .60	4" .60	4" .60	5" .60	6" .70	6" .70

\*Line cut for Nico Base Parts on page 95 can also be used for Rival Boilers.



# NATIONAL PARTS, SECTIONAL BOILERS

Name of Part	14"	18" @	19" +	20" #	25" °	31"	36"	48"
Front Section, Steam or Water.....	\$15.00	\$24.00	\$40.00	\$ 28.00	\$54.00	\$85.00	\$100.00	\$80.00x
Center Section, Steam or Water.....	10.00	18.00	42.00	24.00	54.00	90.00	114.00	87.00x
Tapped Section, Steam or Water.....	11.00	19.00	44.00	26.00	57.00	92.00	117.00	89.00x
Section Next Back, Steam or Water.....	11.00	19.00	43.00	25.00	56.00	87.00	116.00	88.00x
Back Section, Steam or Water (Plain).....	16.00	28.00	48.00	36.00	62.00	92.00	125.00	.....
Back Section, Steam or Water (Tapped).....	.....	.....	50.00	.....	64.00	95.00	128.00	109.00x
Base Front Panel.....	1.50	2.00	3.75	2.25	6.75	7.50	9.50	19.50
Base Back Panel.....	2.00	2.50	4.00	3.75	6.25	8.00	11.00	20.25
Base Side Panel, 4-section.....	2.50	1.50	.....	.....	.....	.....	.....	.....
Base Side Panel, 5-section.....	3.00	2.50	10.50	5.50	9.00	9.50	13.00	15.00
Base Side Panel, 6-section.....	3.50	3.50	11.50	6.75	11.25	11.75	16.00	19.50
Base Side Panel, 7-section.....	4.00	4.50	12.50	8.00	13.50	14.00	19.00	24.00
Base Side Panel, 8-section.....	.....	5.50	13.50	.....	15.75	16.25	22.00	28.50
Base Side Panel, 9-section.....	.....	.....	14.50	.....	18.00	18.50	25.00	33.00
Base Side Panel, 10-section.....	.....	.....	.....	.....	.....	.....	28.00	37.50
Base Side Panel, 11-section.....	.....	.....	.....	.....	.....	.....	.....	42.00
Base Extension per Section.....	.....	.....	4.50	3.50	5.50	6.00	8.50	10.00
Grate Bar.....	.75	1.00	2.50	2.50	4.50	6.75	9.75	18.25
†Grate Connecting Bar, 5-sec. (Wrot Iron).....	.....	.....	.....	.75	1.50	1.75	1.75	2.25
Grate Connecting Bar, 6-sec. (Wrot Iron).....	.....	.....	.....	.75	1.75	2.00	2.00	2.50
Grate Connecting Bar, 7-sec. (Wrot Iron).....	.....	.....	.....	1.00	2.00	2.25	2.50	3.00
Grate Connecting Bar, 8-sec. (Wrot Iron).....	.....	.....	.....	.....	2.25	2.50	2.75	3.50
Grate Connecting Bar, 9-sec. (Wrot Iron).....	.....	.....	.....	.....	.....	3.00	3.25	4.00
Grate Connecting Bar, 10-sec. (Wrot Iron).....	.....	.....	.....	.....	.....	.....	3.50	4.25
Grate Connecting Bar, 11-sec. (Wrot Iron).....	.....	.....	.....	.....	.....	.....	.....	4.75
Grate Lock.....	.15	.15	.15	.15	.15	.15	.25	.25
Angle Lever Bracket.....	.15	.15	.25	.15	.30	.30	.50	.50
Angle Lever Link.....	.....	.....	.....	.15	.15	.15	.15	.15
Angle Lever.....	.50	.60	.50	.50	.75	.50	1.00	1.00
Shaker Handle.....	.75	.75	.75	.75	.75	.75	1.00	1.25
Fire Door.....	1.00	1.00	1.25	2.00	2.25	2.50	3.75	3.00
Fire Door Frame.....	1.00	1.00	.75	1.50	2.50	2.50	3.25	2.50
Fire Door Liner.....	.50	.50	1.25	.50	1.50	1.50	2.00	1.75
Fire Door Slide.....	.30	.30	.25	.25	.25	.25	.30	.15
Fire Door Slide Knob.....	.15	.15	.15	.15	.15	.15	.15	.15
Ashpit Door.....	1.00	1.00	1.50	1.50	1.50	2.00	3.00	3.00
Ashpit Draft Door.....	.30	.30	.50	.30	.75	.75	.75	.75
Ashpit Draft Door Frame.....	.40	.40	.....	.30	.....	.....	.....	.....
Ashpit Draft Slide.....	.30	.....	.....	.15	.....	.....	.....	.....
Ashpit Draft Door Ratchet.....	.15	.15	.15	.15	.15	.15	.15	.15
Ashpit Draft Slide Knob.....	.15	.....	.....	.15	.....	.....	.....	.....
Cleanout Door, Upper.....	1.00	1.50	1.25	1.00	1.75	2.50	3.75	6.00
Cleanout Door Frame, Upper.....	.75	1.50	1.75	.75	2.25	2.00	3.00	4.50
Cleanout Door Liner, Upper.....	.50	.60	.50	.50	1.25	1.25	1.75	3.25
Cleanout Door, Lower.....	.....	.....	.....	.....	.30	1.00	1.00	2.00
Cleanout Door Frame, Lower.....	.....	.....	.....	.....	.30	1.00	1.50	2.75
Clinker Door.....	.30	.30	.75	.75	.75	.75	1.50	1.75
Clinker Door Frame.....	.50	.50	.75	1.25	1.25	.75	2.00	2.50
Clinker Door Liner.....	.25	.30	.50	.50	.50	.50	.75	1.50
Door Handles (Old Style).....	.....	.....	.15	.....	.15	.15	.15	.15
Outside Coil Opening Cover.....	.25	.25	.25	.25	.25	.25	.25	.50
Inside Coil Opening Cover.....	.15	.15	.15	.15	.15	.15	.15	.15
Smoke Hood.....	1.50	3.75	4.00	4.75	6.75	7.00	12.25	15.00
Smoke Hood Turn Damper.....	.50	.75	.75	.75	1.00	1.50	2.50	2.75
Smoke Hood Turn Damper Handle.....	.15	.15	.15	.15	.25	.25	.25	.25
Smoke Hood Turn Damper Ratchet.....	.15	.15	.15	.15	.15	.15	.15	.15
Smoke Hood Check Draft Door.....	.25	.30	.30	.30	1.00	1.00	1.00	1.00
Smoke Hood Check Draft Door Frame.....	.25	.50	.75	.50	.75	1.25	1.50	2.50
Smoke Hood Check Draft Door Ratchet.....	.15	.15	.15	.15	.15	.15	.15	.15
†Angle Lever Con. Arm (Cast Iron).....	.25	.30	.30	.....	.30	.50	.50	.75
Angle Lever Con. Arm 5-6 Sec. (C. I.).....	.....	.....	.....	.....	.....	.75	1.00	1.50
Angle Lever Con. Arm 7-8 Sec. (C. I.).....	.....	.....	.....	.....	.....	1.00	1.50	2.00
Angle Lever Con. Arm 9-10 Sec. (C. I.).....	.....	.....	.....	.....	.....	1.50	2.00	3.00
Grate Connecting Bar, 2-hole (Cast Iron).....	.....	.....	.60	.....	.60	.75	.75	1.00
Grate Connecting Bar, 3-hole (Cast Iron).....	.25	.50	1.00	.....	1.25	1.25	1.50	1.75
Grate Connecting Bar, 4-hole (Cast Iron).....	.25	.50	1.50	.....	1.75	1.75	2.25	2.25
Grate Connecting Bar, 5-hole (Cast Iron).....	.30	.75	.....	.....	2.25	2.25	3.00	3.00
Grate Connecting Bar, 6-hole (Cast Iron).....	.40	.75	.....	.....	.....	.....	.....	.....
Grate Connecting Bar, 7-hole (Cast Iron).....	.50	1.00	.....	.....	.....	.....	.....	.....
Grate Connecting Bar Link (Cast Iron).....	.....	.....	.30	.....	.30	.30	.....	.....
Hoe and Handle.....	1.00	1.00	1.25	1.50	1.75	2.00	2.50	3.00
Poker.....	1.25	1.25	1.50	1.50	1.75	2.50	3.00	3.50
Flue Brush Handle.....	.75	.75	1.00	1.00	1.00	1.25	1.25	2.00
Flue Brush.....	.80	.80	.80	.80	.80	.80	1.00	1.00
Top Nipples, Each.....	2" .60	3" .60	4" .60	4" .60	6" .80	6" .70	6" .70	6" .70
Bottom Nipples, Each.....	2" .60	2" .60	3" .60	2½" .60	3" .60	4" .60	4" .60	4" .60

\*Base Extension list per pair.

†Wrot Iron Grate Connecting Bars used on Series "B" boilers, 20-25-31-36-48 inch; also Series "C", 25 inch.

x48 Series Sections list price for each half.

‡Cast Iron Grate Connecting Bars and Angle Lever Connecting Arms used on First and Series "A" boilers, 14-18-19-25-31-36-48 inch. @ Formerly 17 inch. + Formerly 18 inch. # Formerly 21 inch.

° Formerly 24 inch.



# NATIONAL PARTS, SUPPLY BOILERS

## NOVUS No. 1

Name of Part			Name of Part		
Firepot.....		\$10.00	Bottom Plate.....	NI-10-T	\$2.25
Top Frame.....	NI-1-T	3.25	Base.....	NI-11-T	3.75
Top Front Plate.....	NI-2-T	.30	Cross Lid.....	NI-12-T	.40
Top Back Plate.....	NI-3-T	.30	Damper.....	NI-13-T	.15
Fire Door.....	NI-4-T	.50	Smoke Collar.....	NI-14-T	.30
Baffle Plate.....	NI-5-T	.40	Lid.....	NI-15-T	.50
Slide Center Grate....	NI-6-T	.30	Base Leg.....	LH-16	.25
Outside Grate.....	NI-7-T	.75	Shaker and Lifter....		.25
Draft Door.....	NI-8-T	.15	Hinges.....		.15
Ashpit Door.....	NI-9-T	.50			

## SERIES "A"

Name of Part	No. 9	No. 10	No. 12	No. 14	No. 14½ and No. 14¾	No. 10 Chi.	No. 10 Spec.	No. 12 Spec.
Firepot.....	\$10.00	\$15.00	*	\$28.00	*	\$10.00	\$15.00	*
Ashpit Base Plate	2.00	2.00	\$2.00	3.00	\$3.00	2.00	2.00	\$2.00
Ashpit Feet, each..	.25	.25	.25	.25	.25	.25	.25	.25
Ashpit Ring.....	1.25	1.25	1.25	1.75	1.75	1.25	1.25	1.25
Ashpit Door Frame	1.10	1.10	1.10	1.25	1.25	1.10	1.10	1.10
Ashpit Door.....	.50	.50	.50	.70	.70	.50	.50	.50
Ashpit Dr. Handle				.15	.15			
Ashpit Door Slide	.20	.20	.20	.20	.20	.20	.20	.20
Ashpit Dr. Sl. Knob	.10	.10	.10	.10	.10	.10	.10	.10
Ashpit Right Panel	1.00	1.00	1.00	1.75	1.75	1.00	1.00	1.00
Ashpit Left Panel	1.00	1.00	1.00	1.75	1.75	1.00	1.00	1.00
Panel Strip.....	.20	.20	.20	.20	.20	.20	.20	.20
Grate Ring.....	1.00	1.00	1.20	2.00	2.00	1.00	1.00	1.20
Center Grate Bar	.70	.70	.80	1.10	1.10	.70	.70	.80
Outside Bars, each.	.50	.50	.60	1.00	1.00	.50	.50	.60
Grate Link.....	.20	.20	.20	.20	.20	.20	.20	.20
Grate Spindle....	.20	.20	.20	.20	.20	.20	.20	.20
Grate Spindle Cap	.15	.15	.15	.15	.15	.15	.15	.15
Dump Clip.....	.20	.20	.20	.20	.20	.20	.20	.20
Shaker Handle....	.30	.30	.30	.30	.30	.30	.30	.30
Top Ring.....	2.25	2.25	2.25	2.50	2.50x	4.00	4.00	4.00
Top Plate.....	2.00	2.00	2.00	4.00	4.00x	3.50	3.50	3.50
Lids or Covers, ea.	.60	.60	.60	.60	.60x	.60	.60	.60
Center Cover.....						.50	.50	.50
Baffle Plate.....						.50	.50	.50
Feed Door.....	.40	.40	.40	.40	.60	.60	.60	.60
Feed Door Frame					1.25			
Feed Door Liner..					.20			
Feed Door Slide					.20			
Feed Dr. Sl. Knob					.10			
Lifter.....	.25	.25	.25	.25	.25	.25	.25	.25
Pipe Collar.....					.30a			
Door Handles, each	.15	.15	.15	.15	.15	.15	.15	.15

## SERIES "B"

Name of Part	No. 9-B	No. 10-B	No. 12-B	No. 14 B
Firepot.....			\$20.00	
	Base Parts same as Novus No. 1 Other Parts same as No. 9 Series "A"	Base Parts same as Novus No. 1 Other Parts same as No. 10 Series "A"	Base Parts same as Novus No. 112 Other Parts (except Firepot) same as No. 12 Series "A"	Base Parts same as Novus No. 114 Other Parts same as No. 14 Series "A"

\*Pattern for this firepot destroyed. xUsed only on the 14½ heater.  
aUsed only on the 14½ heater.

# NATIONAL PARTS, SUPPLY BOILERS

Name of Part	No. 106	No. 107A	Nos. 107 & 108	Nos. 109 & 110	No. 112	No. 114	No. 116	No. 118	No. 121
Firepot.....	12.00	17.00	17.00	35.00	25.00	34.00	44.00	49.00	8.00
Water Section.....			7.00x	8.00x					
Screw Nipple.....			3'1.00x	4'1.25x					
Section Band.....			.30x	.40x					
Section Door Frame.....			.20x	.20x					
Section Door.....			.20x	.20x					
Top Ring.....			1.00*	1.25*					
Smoke Dome.....	1.25	1.25	1.25	2.25	2.00	2.50	5.50	5.75	6.25
Smoke Dome Door.....				.25			.30	.30	.30
Smk. Dome Dr. Ratch.....				.15			.15	.15	.15
Smoke Dome Slide.....	.20	.20	.25		.15	.15			
Fire Door Frame.....	.60	.60	1.00	2.00	1.00	1.20	1.50	1.50	1.75
Fire Door.....	.50	.50	.50	.75	.50	.60	1.00	1.00	1.25
Fire Door Liner.....							.60	.60	.60
Fire Door Slide.....	.15	.15	.20	.20	.15	.15	.25	.25	.25
Fire Door Slide Knob.....	.10	.10	.10	.10	.10	.10	.10	.10	.10
Clinker Door Frame.....		.50	.50	.30	.30	.30	.40	.40	.50
Clinker Door.....		.20	.20	.20	.30	.30	.30	.30	.30
Out. Coil Open. Cover.....							.15	.15	.15
Inside Coil Open. Cover.....							.15	.15	.15
Ashpit Base.....	4.00	4.00			5.25	9.50	1.00	12.00	13 50
Ashpit Base Plate.....	2.10	2.10	2.00	3.00	2.00	3.00			
Ashpit Feet, each.....	.25	.25			.25	.25			
Ashpit Door Frame.....			1.10	1.25			1.50	1.50	1.50
Ashpit Door.....	.50	.50	.50	.60	.50	.75	1.00	1.00	1.25
Ashpit Door Slide.....	.15	.15	.20	.20	.15	.15			
Ashpit Dr. Slide Knob.....	.10	.10	.10	.10	.10	.10			
Ashpit Draft Door.....	.15	.15			.15	.15	.50	.50	.50
Ashpit Drft. Dr. Ratch.....							.15	.15	.15
Ashpit Right Panel.....			1.00	1.75					
Ashpit Left Panel.....			1.00	1.75					
Panel Strip.....			.20	.20					
Ashpit Ring.....			2.00	2.75					
Grate Ring.....			1.00	1.20					
Center Grate Bar.....			.70	.80		.90	1.50	1.75	
Outside Grate Bars, ea.....			.50	.50	.90	.60			
Grate Connecting Bar.....			.20	.20	.30	.30	.30	.40	.50
Grate Spindle.....			.20	.20					
Grate Spindle Cap.....			.15	.15					
Dump Clip.....			.20	.20					
Slide Center Grate.....	.30	.30							
Outside Grate (Slide Center Type).....	1.00	1.00							
Front Grate Bar.....							1.00	1.25	1.25
Front Center Grate Bar.....									1.75
Back Center Grate Bar.....									1.75
Back Grate Bar.....							1.00	1.25	1.25
Angle Lever Connecting Arm.....							.30	.30	.30
Grate Lock.....							.15	.15	.15
Angle Lever Bracket.....					.15	.15	.15	.15	.15
Angle Lever.....							.75	.75	.75
Shaker Handle.....			.30	.30	.30	.30	.75	.75	.75
Comb. Lifter & Shaker Poker.....	.25	.25					.75	.75	.75
Scraper.....							.30	.30	.30
Flue Brush Handle.....							.75	.75	.75
Flue Brush.....							.60	.60	.60

xUsed only on the No. 108 and No. 110 heaters.

\*Used only on the No. 107 and No. 109 heaters.

# NATIONAL PARTS, RADIUM BOILERS

## No. 1 SERIES

## No. 2 SERIES

Name of Part	Smoke Hood	Burner Door	Base Back Panel	Base Front Panel	Burner Manifold	Burner Rest	Steam Dome	Smoke Hood	Burner Door	Base Back Panel	Base Front Panel	Burner Manifold	Burner Rest
4-Section..	.90	.60	1.20	.70	.60	.15	5.25	1.50	1.20	2.10	1.60	.90	.20
5-Section..	1.30	.80	1.50	.90	.70	.15	6.50	2.00	1.60	2.70	2.00	1.10	.25
6-Section..	1.70	1.00	1.80	1.10	.80	.15	9.00	2.50	2.00	3.30	2.40	1.20	.30
7-Section..	2.10	1.20	2.10	1.30	.90	.20	9.50	3.00	2.40	3.90	2.80	1.30	.35
8-Section..	.....	.....	.....	.....	.....	.....	10.50	3.50	2.80	4.50	3.20	2.10	.40
9-Section..	.....	.....	.....	.....	.....	.....	11.75	4.00	3.20	5.10	3.60	2.30	.45
10-Section..	.....	.....	.....	.....	.....	.....	14.25	4.50	3.60	5.70	4.00	2.50	.50
11-Section..	.....	.....	.....	.....	.....	.....	15.00	5.00	4.00	6.30	4.40	2.70	.55
12-Section..	.....	.....	.....	.....	.....	.....	15.75	5.50	4.40	6.90	4.80	2.90	.60
13-Section..	.....	.....	.....	.....	.....	.....	17.00	6.00	.....	.....	.....	.....	.....
14-Section..	.....	.....	.....	.....	.....	.....	19.50	6.50	.....	.....	.....	.....	.....
15-Section..	.....	.....	.....	.....	.....	.....	20.00	7.00	Over 12 Secs. Special Panels, List Price .50 per Sec.	Over 12 Secs. Special Panels, List Price .70 per Sec.	Over 12 Secs. Special Panels, List Price .50 per Sec.	Over 12 Secs. Special Panels, List Price .50 per Sec.	.....
16-Section..	.....	.....	.....	.....	.....	.....	21.00	7.50	.....	.....	.....	.....	.....
17-Section..	.....	.....	.....	.....	.....	.....	22.25	8.00	.....	.....	.....	.....	.....
18-Section..	.....	.....	.....	.....	.....	.....	24.75	8.50	.....	.....	.....	.....	.....
19-Section..	.....	.....	.....	.....	.....	.....	25.25	9.00	.....	.....	.....	.....	.....
20-Section..	.....	.....	.....	.....	.....	.....	26.25	9.50	.....	.....	.....	.....	.....

	No. 1 Series	No. 2 Series
Right Base End Panel.....	\$2.25	\$ 5.50
Left Base End Panel.....	2.25	5.50
Burners, each.....	1.00	1.25
Burner Pipes, each.....	.....	.25
Burner Pipe Elbows, each.....	.....	.15
Burner Pipe Nipples, each.....	.....	.15
Air Mixers, each.....	.30	.30
Gas Cocks, each.....	.75	.75
Door Handles, each.....	.15	.15
2 x 5 1/2 Nipples (Steam Dome), each.....	.....	.50
4 x 3 Nipples (Steam Dome), each.....	.....	.75
Flanges (Steam Dome), each.....	.....	.60
Smoke Hood Damper Slide.....	.25	.....
Right End Section.....	6.00	15.00
Left End Section.....	7.00	22.00
Center Section.....	7.00	22.00
Top Nipples.....	2" .60	3" .60
Bottom Nipples.....	2" .60	3" .60



# NATIONAL STEAM BOILER TRIMMINGS

## Used on all Boilers except 31, 36 and 48-inch Sectional

Water Columns.....	\$2.65†
Water Bottle.....	1.15
Pipe and Fittings.....	2.25
Set 3/8-inch Gauge Cocks, complete.....	2.65
Set 1/2-inch Gauge Cocks, complete.....	3.00
3/8-inch Try Cocks, each.....	.90
1/2-inch Try Cocks, each.....	1.15
1/4-inch Pet Cock.....	.55
Steam Gauge Siphon.....	.20
Novus Sensitive Damper Regulator, complete (See Specialty Sheet for Discount).....	15.00

Pop Safety Valves are furnished with Steam Boilers, but charged extra.  
1-inch valve on No. 30 Series Upright Novus and 17-inch, 19-inch and 22-inch Nico.

1 1/4-inch valve on No. 40 Series Upright Novus, 5 section 20-inch Sectional and 25-inch Nico.

1 1/2-inch valve on Nos. 50 and 60 Series Upright Novus, 6 and 7 section 20-inch Sectional and 28-inch Nico.

2-inch valve on 25-inch series Sectional.

2 1/2-inch valve on 31-inch series and 6 section 36-inch Sectional.

3-inch valve on 7, 8, 9 and 10 section 36-inch Sectional.

Two 2 1/2-inch valves on 6 and 7 section, two 3-inch valves on 8 and 9 section; one 3-inch and one 3 1/2-inch valve on 10 and 11 section, 48-inch Sectional.

(For list prices and discount on Pop Safety Valves see Boiler Trade Discount Sheet.)

See Specialty Sheet for price on Steam Gauges.

See Specialty Sheet for prices on Service Regulator and Regulating Valves.

Large Flue Brush supplied with 36-inch and 48-inch Sectional Boilers.

Price.....\$1.00

Medium Flue Brush supplied with 20-25-31-inch Sectional Boilers.

Price.....\$0.80

Small Flue Brush supplied with all Novus Upright and Nico Round Boilers.

Price.....\$0.60

## 31, 36 and 48-inch Sectional Boilers

Water Column.....	\$3.00
Water Bottle.....	1.50
Pipe and Fittings.....	2.65
Set 1/2-inch Gauge Cocks, complete.....	3.00
1/2-inch Try Cocks, each.....	1.15

## List Price of Parts to Increase Boiler One Size

Novus Sectional	Steam	Novus Sectional	Water
20-inch.....	\$ 41.00	20-inch.....	\$ 41.00
25-inch.....	79.00	25-inch.....	79.00
31-inch.....	123.00	31-inch.....	123.00
36-inch.....	150.00	36-inch.....	150.00
48-inch.....	233.00	48-inch.....	233.00
Novus Upright	Steam or Water	Nico Round	Steam or Water
10-Series.....	\$15.00	17-inch.....	\$14.00
20-Series.....	17.00	19-inch.....	16.00
30-Series.....	23.00	22-inch.....	18.00
40-Series.....	28.00	25-inch.....	23.00
50-Series.....	36.00	28-inch.....	38.00
60-Series.....	41.00		

†All Novus Upright and 14-inch and 18-inch Sectional Boilers have Water Columns cast on section.

## Sectional Boiler Assembling Chart

F—Front Section; T—Plain Tap Section; N—Next to Back Tapped Section; M—Next to Back Center Section; C—Center Section; B—Back Section.

14-Inch.....	F T C N B	5 Sec. 18-Inch.....	F T C N B
14-Inch.....	F T C C N B	6 Sec. 18-Inch.....	F T C C N B
14-Inch.....	F T C T C N B	7 Sec. 18-Inch.....	F T C T C N B
20-Inch....	F T C N B	5 Sec. 25-Inch.....	F T C N B
20-Inch....	F T C C N B	6 Sec. 25-Inch.....	F T C C N B
20-Inch....	F T C T C N B	7 Sec. 25-Inch.....	F T C T C N B
		8 Sec. 25-Inch.....	F T C T C C N B
31-Inch..	F T C C N B	6 Sec. 36-Inch..	F T C C N B
31-Inch..	F T C T C N B	7 Sec. 36-Inch..	F T C T C N B
31-Inch..	F T C T C C N B	8 Sec. 36-Inch..	F T C T C C N B
31-Inch..	F T C C T C C N B	9 Sec. 36-Inch..	F T C C T C C N B
		10 Sec. 36-Inch..	F T C C T C C C N B

Left Hand					48-Inch	Right Hand				
				B N C C T F...	6 Sec...	F C C C M B				
				B N C C C T F...	7 Sec...	F C C C C M B				
				B N C C C C T F...	8 Sec...	F C C T C C M B				
				B N C C C C C T F...	9 Sec...	F C C T C C C M B				
				B N C C C C C C T F...	10 Sec...	F C C T C C C C M B				
				B N C C C C C C C T F...	11 Sec...	F C C T C C C T C C M B				
				B N C C C C C C C C T F...	12 Sec...	F C C T C C C T C C C M B				

Note: "N"—Tapping on the 25-inch and 36-inch is on the right-hand side facing boiler.

"N"—Tapping on the 31-inch and 48-inch is on the left-hand side facing boiler.

"N"—Tapping on the 14-inch, 18-inch and 20-inch and "T" on all sizes can be placed on either side.

## Arrangement of Cast Iron Grate Connections

	14	14	14	14	18	18	18	18	18	19	19	19	19	25	25	25	25	25	25
	-4	-5	-6	-7	-4	-5	-6	-7	-8	-5	-6	-7	-8	-5	-6	-7	-8	-9	-9
Angle Lever Conn. Arm...	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Grate Conn. Bar (2 hole)...											1								
Grate Conn. Bar (3 hole)...	1				1						1	2	1			2	1		
Grate Conn. Bar (4 hole)...		1			1					1			1	1			1	2	
Grate Conn. Bar (5 hole)...			1			1									1				
Grate Conn. Bar (6 hole)...				1			1												
Grate Conn. Bar (7 hole)...								1											
Grate Conn. Bar Link.....											1	1	1			1	1	1	
	31	31	31	31	31	36	36	36	36	36	36	48	48	48	48	48	48	48	48
	-5	-6	-7	-8	-9	-5	-6	-7	-8	-9	-10	-5	-6	-7	-8	-9	-10	-11	-11
Angle Lever Conn. Arm																			
(Front Group).....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Angle Lever Conn. Arm...																			
5 & 6 Sec. (Rear Group)	1	1				1	1					1	1						
Angle Lever Conn. Arm																			
7 & 8 Sec. (Rear Group)			1	1				1	1					1	1				
Angle Lever Conn. Arm...																			
9 & 10 Sec. (Rear Group)					1					1	1					1	1		
Angle Lever Conn. Arm																			
11 & 12 Sec. (Rear Group)																			1
Grate Conn. Bar (2 hole)...	2	1				2	1					2	1						
Grate Conn. Bar (3 hole)...		1	2	1			1	2	1				1	2	1				
Grate Conn. Bar (4 hole)...				1	2					1	2	1				1	2	1	
Grate Conn. Bar (5 hole)...												1						1	2

On the 19, 25, 31 and 36 Series each Grate Connecting Bar is not always a single unit. By using a Connecting Bar Link a 2 hole and a 3 hole bar may be made into a 5 hole bar, etc., etc.

The 20 Series (formerly 21) was never made with Cast Iron Grate Connections.



## Base Characteristics of Sectional Boilers

### First Series (No Serial Letter added to size No.)

14, 18<sup>1</sup>, 19<sup>2</sup>, 25<sup>3</sup>, 31, 36 and 48 Series.

Cast Iron Grate Connections.

Straight Lug Cotter Pin type of Grate Bars on 14, 19, 25, 31 and 36 Series; Angle Lug type of Grate Bars (No Cotter Pins) on 18 and 48 Series.

14, 18, 19 and 25 Series shake from one side only (left); 31, 36 and 48 Series shake from both sides.

All Grate Bars for double shaker Boilers reversible (no rights and lefts).

All Grate Bars for each series alike except the 18 Series. This has two kinds of Grate Bars—Center Bars and End Bars (front and back).

On double shaker Boilers with an odd number of grates the extra Grate Bar is connected to the rear Grate Connecting Bar. Grate Connecting Bar for front or rear group of grates can be placed on either side of the boiler. This makes it possible to use the same Angle Lever Connecting Arm (rear group) on two sizes of boilers of any one series.

On 19 and 25 Series Angle Lever Bracket is cast on Base Front Panel; no Angle Lever Link is required.

<sup>1</sup> Formerly listed as 17 inch.    <sup>2</sup> Formerly listed as 18 inch.    <sup>3</sup> Formerly listed as 24 inch.

### Series "A" (Serial Letter "A" added to size No.)

19, 25, 31, 36 and 48 Series.

The same as "First" Series with one exception; Angle Lever Bracket on 19 and 25 Series made as a separate casting, but of the original type.

### Series "B" (Serial Letter "B" added to size No.)

20<sup>4</sup>, 25, 31, 36 and 48 Series.

Wrought Iron Grate Connections. These extend in one piece from the Angle Lever back the entire length of the boiler and through Back Base Panel. They serve as both Angle Lever Connecting Arms and Grate Connecting Bars.

Angle Lug type of Grate Bars (no Cotter Pins).

All Grate Bars for double shaker Boilers reversible (no rights and lefts).

All Grate Bars for each series alike.

20 Series shakes from one side only (left), balance same as "First" Series.

On double shaker Boilers with an odd number of grates the extra bar is attached to Grate Connecting Bar operating the front group of Grate Bars. This may be on either side of the boiler.

Clevis type of Angle Lever Bracket requiring an Angle Lever Link. This Bracket not interchangeable with the Series "A" Bracket.

Base Back Panel slotted for Grate Connecting Bars.

Grate Carriers placed slightly lower on Base Side Panels than on two earlier series. Base Side Panel Extension for "B" Series and former series not interchangeable.

The 20 Series does not carry the Serial letter "B" in the size number but Boilers have all other features of the "B" Series.

<sup>4</sup> Formerly listed as 21 inch.

### Series "C" (Serial Letter "C" added to size No.)

25 Series only.

The same as Series "B" with this exception: Boilers equipped with double shaking device.

Back group of Grates must be connected to right-hand Grate Connecting Bar which is offset.

Right and Left Grate Connecting Bars on the 25 Series not interchangeable.

Front and Back Base Panels slotted to receive right-hand Grate Connecting Bar.

## Boiler Capacity and Horse Power

1. One square foot of active heating surface will evaporate from 3 to 6 pounds of water per hour, from and at 212 degrees Fahrenheit.

2. 34.5 pounds of water per hour evaporated from and at 212 degrees Fahrenheit equals 1 "horse power."

3. The quantity of heating surface per "horse power" depends upon the rate of evaporation and varies in different types of boilers and different draft intensities from 6 to 12 square feet. For the same reason 1 square foot of heating surface will supply from 12 to 14 square feet of steam radiation without undue fuel waste.

4. One "horse power" will supply 138 square feet of average cast-iron radiation under normal conditions of installation ( $34.5 \times 4 = 138$ ), and under such conditions 4 square feet of radiation is required to condense 1 pound of steam per hour. The hourly evaporation in pounds times 4 gives the heating power in terms of radiation.

5. If the evaporation per square foot of heating surface per hour is 2 pounds, the radiation capacity is ( $4 \times 2$ ) 8 square feet of heating surface, and the capacity of a boiler containing 60 square feet of heating surface would be ( $60 \times 8$ ) 480 square feet of steam radiation.

6. If the evaporation per square foot of heating surface per hour is 5 pounds, the radiation capacity is ( $4 \times 5$ ) 20 square feet per square foot of heating surface, and the capacity of a boiler containing 60 square feet of heating surface would be ( $60 \times 20$ ) 1,200 square feet.

7. If the rated capacity of a steam boiler is based on exact tests, divide the capacity by 138 and the quotient is the "horse power."

8. A little study of the foregoing will convince any reasonable mind that it is as unfair as it is erroneous to fix arbitrarily the ratio of radiation to heating surface before knowing the evaporative power of the boiler when operating at various rates of combustion.

## Chimneys

**B**ADLY built or too small chimney flues cause a waste of one-third of all the coal that is burned in the United States. In the interest of fuel economy and the satisfactory operation of heating plants, the following facts are presented.

When a building is to be heated, especially residences, too often the heating man finds that a chimney which is not the proper size has been provided. That means tearing down the chimney—added expense and delay. Rather than lose the work a boiler for which the chimney is not fitted is installed. The property owner is then left to fight the cold by using twice as much coal as is needed and consequently with a heating plant which is a source of worry, added expense and dissatisfaction.

A chimney serves two purposes. One is to carry off the products of combustion—the other to create a motive force by which air is driven through the ashpit and flue. It is commonly assumed that 25% of the fuel energy or heat units released by burning coal are expended in producing sufficient draft for proper fuel combustion.

Draft is the motion of gases produced by an excess of pressure at any point over that at another point toward which such gases are flowing. The difference in height between the hot gases in the chimney and a column of gases of equal height at the temperature of the outside air, creates a motion toward and through the bed of fuel. The greater the height of the chimney, the greater will be the motive power or movement of the gases, and the larger the amount of air which will pass through the bed of fuel.

The motion of the gases has no direct bearing upon the size of the chimney, but the area or the size of the chimney is dependent on the volume of gases which is the result of combustion. Approximately 300 cubic feet of air is required to furnish the oxygen necessary for the complete combustion of a pound of fuel. If we desire to operate an apparatus having 5 square feet of grate area burning fuel at the rate of 5 pounds of coal per square foot of grate per hour, the total consumption of fuel would be 25 pounds and the air necessary for its complete combustion  $25 \times 300$  or 7500 cubic feet. The velocity in the flue should equal .15 to .2 of an inch of water in draft gauge which is at the rate of 21 feet per second.

Due to rarefied air in localities situated a great distance above sea level, a larger volume of air must be supplied in order to furnish the proper amount of oxygen necessary for good combustion. Chimney flue sizes are based upon sea level conditions and 2% must be added to these areas for each 500 feet above sea level.

If burning coal in the boiler does not get the proper amount of air, it decomposes and throws out only a fraction of its heat (the difference between carbon dioxide and carbon monoxide). Likewise too much air chills the fire — puts it out.

The value of the chimney flue consequently depends upon its area and velocity. Velocity alone is no proof of good draft—there must be sufficient area to carry the gases of combustion. It is better to build the chimney flue in generous area and height, for the flue can be choked down by dampers. But a chimney that is too small is always a failure. The correct way is to build a chimney that is of the right size to suit the cubical contents and exposure of the building, also the altitude of the city.

## Chimneys (Continued)

The most important feature about a chimney, aside from its area and height, is that it should run above the highest point of the roof. It should be located with reference to higher buildings in order that wind currents will not form and force the air downward in the flue. Figure Nos. 1, 2 and 3 show chimneys as commonly installed and the dotted lines as they should be installed.

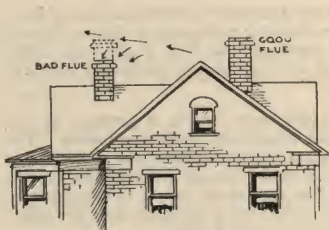


Figure No. 1

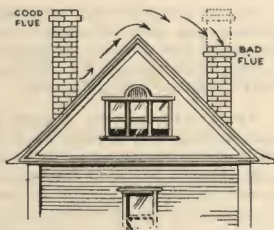


Figure No. 2

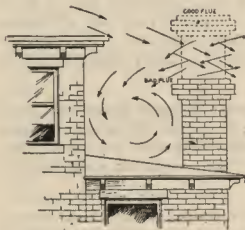


Figure No. 3

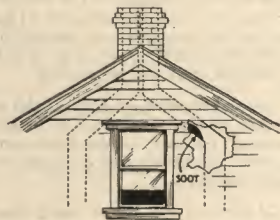


Figure No. 4

A chimney flue should run as nearly straight as possible from its base to its top, and be **the same area all the way**. Offset chimneys are easily choked with soot. Figure No. 4 is an example.



### Chimneys (Continued)

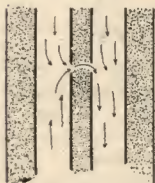
Care should be taken in placing the smoke pipe or connecting the boiler to the chimney. The boiler should be so located that there are no long smoke pipe runs and the connection made directly to the chimney opening eliminating all unnecessary elbows. In running the smoke pipe into the chimney opening this must not run beyond the inside wall of the chimney.

For best results, a chimney should be stopped off or should not extend more than six inches below smoke pipe connection.

Chimneys invariably cause trouble when there is more than one opening. When there is more than one opening all except the one for the boiler smoke pipe should be closed tight. A boiler should operate on a separate chimney.



When there is an opening into a chimney from a fire place, such an opening should be closed tight. A fireplace and boiler will not work satisfactorily on the same chimney.



Many chimneys are poorly built and left filled with mortar and brick. Care should be taken that they are perfectly clean.

Care should be exercised that chimneys are tight throughout. Double chimneys oftentimes contain leaks resulting in poor drafts and the total demoralization of the heating system. Figure No. 5 is an example.

Figure No. 5

Smoke pipes should be cemented into the chimney or furnished with a special collar to make a tight connection. If they are not tight throughout, air leakage and a poor draft result.

The round chimney tile-lined, is the best form as smoke and gases pass up with least resistance. The next best chimney from the point of efficiency is a tile lined square chimney; or one that is practically square. A rectangular chimney is oftentimes used but in this event the depth must not be less than the diameter of the smoke pipe entering it.

On page 110 we give Prof. R. C. Carpenter's table of chimney dimensions. for various amounts of steam and water radiation. The available draft of such chimneys, as measured by an ordinary draft gauge, should approximate the values given in the table immediately following.



# DATA FOR THE FITTER

## Size of Chimney Flues

Direct Radiation		Height of Chimney Flue (feet) Diameter of Chimney Flue (Inches)				
Steam in Square Feet	Water in Square Feet	30 Feet	40 Feet	50 Feet	60 Feet	80 Feet
250	375	7.0	6.7	6.4	6.2	6.0
500	750	9.2	8.8	8.2	8.0	6.6
750	1,150	10.8	10.2	9.6	9.3	8.8
1,000	1,500	12.0	11.4	10.8	10.5	10.0
1,500	2,250	14.4	13.4	12.8	12.4	11.5
2,000	3,000	16.3	15.2	14.5	14.0	13.2
3,000	4,500	18.5	18.2	17.2	16.6	15.8
4,000	6,000	22.2	20.8	19.6	19.0	17.8
5,000	7,500	24.6	23.0	21.6	21.0	19.4
6,000	9,000	26.8	25.0	23.4	22.8	21.2
7,000	10,500	28.8	27.0	25.5	24.4	23.0
8,000	12,000	30.6	28.6	26.8	26.0	24.2
9,000	13,500	32.4	30.4	28.4	27.4	25.6
10,000	15,000	34.0	32.0	30.0	28.6	27.0

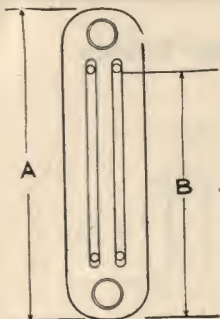
## Draft in Small Chimneys

Height in Feet	Temperature of Chimney Gases, Degrees F.		
	200	250	300
	Draft—Inches in Water		
60.....	0.27	0.32	0.35
55.....	0.25	0.29	0.32
50.....	0.23	0.26	0.29
45.....	0.21	0.23	0.26
40.....	0.18	0.21	0.23
35.....	0.16	0.19	0.20
30.....	0.14	0.16	0.17
25.....	0.12	0.14	0.14
20.....	0.09	0.11	0.12

The dimensions of a chimney can be computed from the foregoing table. If the flue is square, the sides should be equal in length to the diameter of a round flue given in the table, it being assumed that the corners of a square flue are not effective.

In measuring the available draft, the gauge should be connected to the breeching on the chimney side of the damper. The fire should be regulated so that the temperature of the stack gases will approximate working conditions and the damper should be quickly closed immediately before the reading is taken.

## Measurements Premo Legless Radiators and Intermediate Sections



A—Distance from bottom of hub to top of radiator.

B—Distance from bottom of hub to center of top connecting bolt.

### 1 Column

	38 Inches	32 Inches	26 Inches	23 Inches	20 Inches
A.....	$35\frac{1}{16}$	$29\frac{1}{16}$	$23\frac{1}{16}$	$20\frac{1}{16}$	$17\frac{1}{16}$
B.....	$30\frac{5}{16}$	$24\frac{3}{16}$	$18\frac{3}{16}$	$16\frac{3}{16}$	$12\frac{3}{16}$

### 2 Column

	44 Inches	38 Inches	32 Inches	26 Inches	23 Inches	20 Inches
A.....	$41\frac{1}{16}$	$35\frac{1}{16}$	$29\frac{1}{16}$	$23\frac{1}{16}$	$20\frac{1}{16}$	$17\frac{1}{16}$
B.....	$36\frac{3}{16}$	$30\frac{3}{16}$	$24\frac{3}{16}$	$18\frac{3}{16}$	$15\frac{3}{16}$	$12\frac{3}{16}$

### 3 Column

	44 Inches	38 Inches	32 Inches	26 Inches	22 Inches	18 Inches
A.....	$41\frac{1}{16}$	$35\frac{1}{16}$	$29\frac{1}{16}$	$23\frac{1}{16}$	$19\frac{1}{16}$	$15\frac{1}{16}$
B.....	$36\frac{3}{16}$	$30\frac{3}{16}$	$24\frac{1}{16}$	$18\frac{7}{16}$	$14\frac{1}{16}$	$10\frac{1}{16}$

### 4 Column

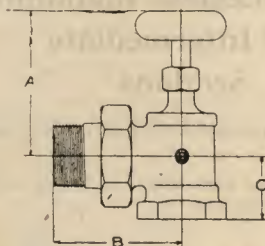
	44 Inches	38 Inches	32 Inches	26 Inches	22 Inches	18 Inches
A.....	$41\frac{1}{16}$	$35\frac{1}{16}$	$29\frac{1}{16}$	$23\frac{1}{16}$	$19\frac{1}{16}$	$15\frac{1}{16}$
B.....	36	30	24	18	14	10

### 5 Column

	20 Inches	16 Inches	13 Inches	....	....
A.....	$18\frac{3}{4}$	$14\frac{3}{4}$	$11\frac{3}{4}$	....	....
B.....	$13\frac{3}{8}$	$9\frac{1}{8}$	$6\frac{7}{8}$	....	....

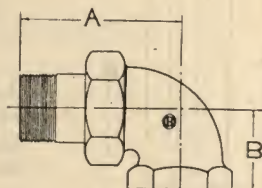
The above measurements are for water legs and the return leg on two pipe steam. To secure the measurement "A" on one pipe steam or the feed leg on two pipe steam, add  $\frac{1}{2}$  inch to the dimensions shown.

## Dimensions of Radiator Valves



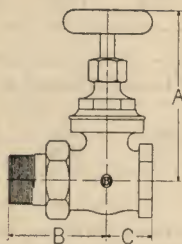
Hot Water Radiator Valve

Size Inches	A	B	C
$\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{4}$	$1\frac{1}{8}$
$\frac{3}{4}$	3	$2\frac{11}{16}$	$1\frac{1}{4}$
1	$3\frac{5}{8}$	3	$1\frac{1}{2}$
$1\frac{1}{4}$	$4\frac{1}{8}$	$3\frac{1}{2}$	$1\frac{5}{8}$
$1\frac{1}{2}$	$4\frac{1}{4}$	$3\frac{9}{16}$	$1\frac{7}{8}$
2	$5\frac{1}{8}$	$4\frac{1}{4}$	$2\frac{1}{4}$



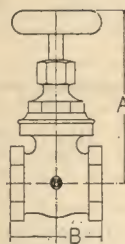
Union Elbow

Size Inches	A	B
$\frac{1}{2}$	$2\frac{3}{8}$	$1\frac{1}{8}$
$\frac{3}{4}$	$2\frac{1}{2}$	$1\frac{1}{4}$
1	3	$1\frac{1}{2}$
$1\frac{1}{4}$	$3\frac{1}{2}$	$1\frac{5}{8}$
$1\frac{1}{2}$	$3\frac{5}{8}$	$1\frac{7}{8}$
2	$4\frac{1}{2}$	$2\frac{1}{4}$



Radiator Gate Valve  
with Union

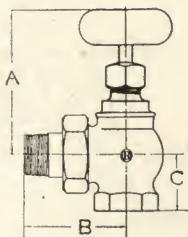
Size Inches	A	B	C
$\frac{1}{2}$	$3\frac{5}{8}$	$2\frac{3}{8}$	1
$\frac{3}{4}$	$4\frac{1}{4}$	$2\frac{5}{8}$	$1\frac{1}{8}$
1	$4\frac{3}{4}$	$2\frac{7}{8}$	$1\frac{1}{4}$
$1\frac{1}{4}$	$5\frac{5}{8}$	$3\frac{3}{8}$	$1\frac{1}{2}$
$1\frac{1}{2}$	$6\frac{3}{8}$	$3\frac{1}{2}$	$1\frac{5}{8}$
2	$7\frac{1}{2}$	$4\frac{1}{4}$	$1\frac{3}{4}$



Radiator Gate Valve  
without Union

Size Inches	A	B
$\frac{1}{2}$	$3\frac{5}{8}$	2
$\frac{3}{4}$	$4\frac{1}{4}$	$2\frac{1}{4}$
1	$4\frac{3}{4}$	$2\frac{5}{8}$
$1\frac{1}{4}$	$5\frac{5}{8}$	3
$1\frac{1}{2}$	$6\frac{3}{8}$	$3\frac{1}{4}$
2	$7\frac{1}{2}$	$3\frac{1}{2}$

## Dimensions of Radiator Valves



Angle Type

Size Inches	A	B	C
$\frac{1}{2}$	4	$2\frac{5}{16}$	$1\frac{1}{8}$
$\frac{3}{4}$	$4\frac{3}{8}$	$2\frac{11}{16}$	$1\frac{1}{4}$
1	$5\frac{3}{8}$	$3\frac{1}{4}$	$1\frac{3}{8}$
$1\frac{1}{4}$	$6\frac{1}{8}$	$3\frac{1}{32}$	$1\frac{5}{8}$
$1\frac{1}{2}$	$6\frac{1}{4}$	$3\frac{5}{8}$	$1\frac{3}{4}$
2	$7\frac{1}{8}$	$4\frac{1}{4}$	$2\frac{3}{8}$

"A" when valves are open.

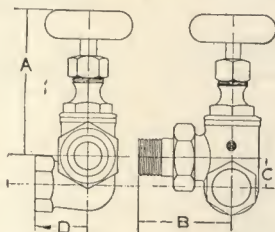


Globe

Sizes	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$
A ....	$4\frac{7}{8}$	$5\frac{1}{4}$	$5\frac{3}{4}$	7
B ....	$2\frac{3}{4}$	$3\frac{5}{16}$	$3\frac{1}{8}$	$4\frac{1}{4}$
C ....	$2\frac{1}{2}$	$2\frac{7}{8}$	3	$3\frac{1}{4}$
Sizes	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3
A ....	$7\frac{1}{4}$	$8\frac{1}{2}$	$9\frac{5}{8}$	$10\frac{1}{8}$
B ....	$4\frac{7}{8}$	$5\frac{3}{4}$	$6\frac{3}{8}$	$8\frac{1}{2}$
C ....	$4\frac{1}{8}$	$4\frac{3}{8}$	5	6

"A" when valves are open.

## Right and Left-Hand Corner Type



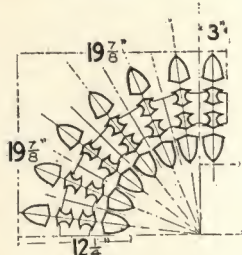
Size, Inches	A	B	C	D
$\frac{3}{4}$	$4\frac{7}{8}$	$2\frac{5}{8}$	$\frac{3}{4}$	$1\frac{3}{8}$
1	$5\frac{3}{8}$	$3\frac{1}{4}$	$\frac{7}{8}$	$1\frac{1}{2}$
$1\frac{1}{4}$	$6\frac{1}{8}$	$3\frac{9}{16}$	$1\frac{1}{4}$	$1\frac{3}{4}$
$1\frac{1}{2}$	$7\frac{1}{4}$	$3\frac{5}{8}$	$1\frac{1}{4}$	2
2	$8\frac{3}{8}$	$4\frac{1}{4}$	$1\frac{3}{4}$	$2\frac{3}{8}$

"A" when valves are open.

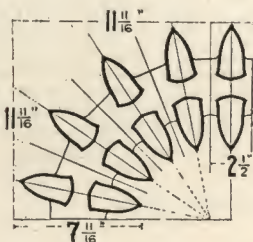
# Measurements 90° Corner Radiators



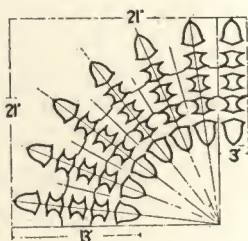
Measurements of Premo One-Column Corner Radiator. For section ratings, see page 35.



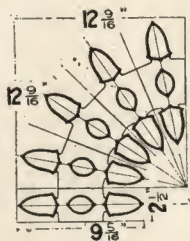
Measurements of Premo Four-Column Corner Radiator. For section ratings, see page 41.



Measurements of Premo Two-Column Corner Radiator. For section ratings, see page 37.



Measurements of Premo Five-Column Corner Radiator. For section ratings, see page 42.



Measurements of Premo Three-Column Corner Radiator. For section ratings, see page 39.

Important—In ordering corner radiators kindly indicate by sketch which is supply and which is return end. We give the number of sections for each corner and it is necessary that your sketch indicate how many sections are to be used on each side, exclusive of those required to make the corner.



# Proportioning Radiation

## Rule No. 1

### "Rule of Thumb"

#### For Steam and Water Heating

One Square Foot of Direct Radiation Will Heat

Dwellings	Cu. Ft. by Hot Water	Cu. Ft. by Steam
Living rooms, one side exposed. . . .	25 to 30	45 to 50
Living rooms, two sides exposed . .	20 to 30	40 to 50
Living rooms, three sides exposed .	20 to 25	35 to 45
Sleeping rooms. . . . .	30 to 40	50 to 60
Halls and bathrooms. . . . .	20 to 30	40 to 50
Public Buildings		
Offices. . . . .	30 to 50	50 to 75
Schoolrooms. . . . .	20 to 30	55 to 80
Factories and stores. . . . .	40 to 60	80 to 100
Assembly halls and churches. . . . .	60 to 80	100 to 125

This method of figuring considers only the cubic contents of the rooms to be heated. Experience in heating is necessary in order to determine the proper factor to be used for different conditions. The radiating surface which will be required for any room will largely depend upon the proportion of exposed wall and glass surface in relation to its cubic contents. The proportion is based upon a detached building of the average construction and exposure, and outside temperature zero.

To secure the best results, the figures given above should be increased 50 to 75 per cent for Indirect and 35 to 50 per cent for Semi-Direct Heating.

## Proportioning Radiation

### Rule No. 2

#### "Carpenters Rule"

##### For Steam and Water Heating

Professor R. C. Carpenter, of Cornell University, submits the following rule for determining the size radiator needed for a given room:

Rule—Add the area of the glass surface in the room to one-quarter of the exposed wall surface, and to this add from  $\frac{1}{8}$  to  $\frac{3}{8}$  of the cubical contents ( $\frac{1}{8}$  for rooms on upper floor,  $\frac{2}{8}$  for rooms on first floor and  $\frac{3}{8}$  for large halls); then for steam multiply by .25 and for hot water by .40.

Example—A room 20 x 12 x 10 feet with glass exposure of 48 feet, one-quarter of wall exposure (two sides exposed) 320 feet = 80,  $\frac{1}{8}$  of 2400 = 44.

$48 + 80 + 44 = 172 \times .25 = 43$  feet for steam.

If you add  $\frac{2}{8}$  the surface would be 54 feet.

If you add  $\frac{3}{8}$  the surface would be 65 feet.

For water determine radiation by steam rule and above factors and multiply by 1.65.

For Garages and other buildings, having a large number of air changes per hour, additional radiator should be provided.

### Rule No. 3

#### "Mills Rule"

##### For Steam and Water Heating

One square foot of radiating surface for each 2 square feet of glass, and for each 20 square feet of exposed outside wall and each 200 cubic feet of space.

Example—A given room has 60 square feet of glass, 220 square feet of exposed wall and 2000 cubic feet of air. (Room is on first floor.)

Cubic contents  $2000 \div 200$  ..... = 10 square feet of radiation

Glass  $60 \div 2$  ..... = 30 square feet of radiation

Wall  $220 \div 20$  ..... = 11 square feet of radiation

Total. .... 51 square feet of radiation

Above figures are for steam. For water (in accordance with accepted standards) add 65 per cent. This would add for the above 33 square feet and make a total of 84 square feet.

# DATA FOR THE FITTER

## Area of Two-Pane Windows

Giving the total area of Two-Pane Windows, including the Sash

Width Glass Inches	Width Open'g Ft. In.	Height		18"	20"	22"	24"	26"	28"	30"	32"	34"	36"	38"	40"	42"	44"	46"	48"	50"	52"	54"
		Height Opening		3'-6"	3'-10"	4'-2"	4'-6"	4'-10"	5'-2"	5'-6"	5'-10"	6'-2"	6'-6"	6'-10"	7'-2"	7'-6"	7'-10"	8'-2"	8'-6"	8'-10"	9'-2"	9'-6"
16	1-8	Standard Sizes of Two-Light Windows.		5.8	6.4	7.0	7.5	8.0	8.6	9.2	9.7	10.3	10.8	11.4	11.9	12.5	13.0	13.6	14.2	14.7	15.2	15.8
18	1-10			6.4	7.0	7.6	8.2	8.9	9.5	10.1	10.7	11.3	11.9	12.5	13.1	13.7	14.3	15.0	15.6	16.2	16.8	17.4
20	2-0			7.0	7.7	8.3	9.0	9.7	10.3	11.0	11.7	12.3	13.0	13.6	14.3	15.0	15.6	16.3	17.0	17.7	18.3	19.0
22	2-2			7.6	8.3	9.0	9.7	10.5	11.2	11.9	12.6	13.4	14.0	14.7	15.5	16.2	17.0	17.7	18.4	19.2	19.8	20.6
24	2-4			8.2	8.9	9.7	10.5	11.3	12.0	12.8	13.6	14.4	15.1	15.9	16.7	17.4	18.2	19.0	19.8	20.6	21.4	22.2
26	2-6			8.7	9.6	10.4	11.2	12.0	12.8	13.7	14.6	15.4	16.2	17.1	17.9	18.7	19.5	20.4	21.2	22.0	23.0	23.8
28	2-8			9.3	10.2	11.1	12.0	12.9	13.8	14.7	15.5	16.4	17.3	18.2	19.1	20.0	20.8	21.8	22.6	23.5	24.4	25.3
30	2-10			10.0	10.8	11.8	12.8	13.7	14.6	15.6	16.5	17.5	18.4	19.3	20.3	21.2	22.2	23.2	24.0	25.0	26.0	27.0
32	3-0			10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5	23.5	24.5	25.5	26.5	27.5	28.5
34	3-2			11.0	12.1	13.2	14.3	15.3	16.4	17.4	18.5	19.5	20.6	21.6	22.6	23.7	24.8	25.8	27.0	28.0	29.0	30.0
36	3-4			11.7	12.8	13.9	15.0	16.1	17.2	18.3	19.5	20.5	21.6	22.8	23.8	25.0	26.1	27.2	28.3	29.4	30.5	31.7
38	3-6			12.2	13.4	14.6	15.8	16.9	18.0	19.2	20.4	21.6	22.7	24.0	25.0	26.2	27.4	28.6	29.8	31.0	32.1	33.2
40	3-8			12.8	14.0	15.3	16.5	17.7	18.9	20.1	21.4	22.6	23.8	25.1	26.2	27.4	28.7	30.0	31.2	32.4	33.6	34.9
42	3-10			13.4	14.7	16.0	17.3	18.5	19.8	21.0	22.4	23.6	24.9	26.2	27.4	28.6	30.0	31.3	32.6	33.8	35.0	36.4
44	4-0			14.0	15.3	16.7	18.0	19.3	20.7	22.0	23.4	24.6	26.0	27.3	28.6	30.0	31.3	32.6	34.0	35.3	36.5	38.0
46	4-2			14.6	16.0	17.4	18.8	20.1	21.5	23.0	24.4	25.6	27.1	28.4	29.8	31.2	32.6	34.0	35.5	36.8	38.2	39.6
48	4-4			15.2	16.6	18.0	19.5	20.9	22.4	23.8	25.3	26.7	28.1	29.5	31.0	32.4	34.0	35.4	36.8	38.3	39.6	41.0
50	4-6			15.7	17.2	18.7	20.3	21.8	23.2	24.8	26.2	27.7	29.2	30.7	32.2	33.7	35.2	36.7	38.2	39.7	41.2	42.6
52	4-8			16.3	17.9	19.4	21.0	22.5	24.0	25.6	27.2	28.7	30.3	31.8	33.4	35.0	36.5	38.0	39.6	41.2	42.7	44.2
54	4-10			16.9	18.5	20.1	21.8	23.4	25.0	26.6	28.2	29.8	31.4	32.9	34.6	36.2	37.8	39.5	41.0	42.7	44.3	46.0
56	5-0			17.5	19.3	20.8	22.5	24.2	25.8	27.5	29.0	30.8	32.5	34.0	35.8	37.5	39.8	40.8	42.5	44.2	46.0	47.5

## Fitter's Guide

### For Figuring Steam Radiation

The formula under which the following tables were prepared has been used in the Northern states for fifteen years and can be recommended to those desiring the best results from the plants they install. Separate copies mailed upon application.

Cubic Contents of Room	Feet Radiation Required	Cubic Contents of Room	Feet Radiation Required	Cubic Contents of Room	Feet Radiation Required	Sq. Ft. Exposed Wall Surface	Feet Radiation Required	Sq. Ft. Exposed Wall Surface	Feet Radiation Required	Square Feet Glass Surface	Feet Radiation Required	Square Feet Glass Surface	Feet Radiation Required
350	4	1900	19	5200	52	16	1	368	23	4	1	48	16
400	4	2000	20	5400	54	32	2	384	24	6	2	50	17
450	5	2100	21	5600	56	48	3	400	25	8	3	52	17
500	5	2200	22	5800	58	64	4	416	26	10	3	54	18
550	6	2300	23	6000	60	80	5	432	27	12	4	56	19
600	6	2400	24	6200	62	96	6	448	28	14	5	58	19
650	7	2500	25	6400	64	112	7	464	29	16	5	60	20
700	7	2600	26	6600	66	128	8	480	30	18	6	62	21
750	8	2700	27	6800	68	144	9	496	31	20	7	64	21
800	8	2800	28	7000	70	160	10	512	32	22	7	66	22
850	9	2900	29	7200	72	176	11	528	33	24	8	68	23
900	9	3000	30	7400	74	192	12	544	34	26	9	70	23
950	10	3200	32	7600	76	208	13	560	35	28	9	74	25
1000	10	3400	34	7800	78	224	14	576	36	30	10	78	26
1100	11	3600	36	8000	80	240	15	592	37	32	11	82	28
1200	12	3800	38	8200	82	256	16	608	38	34	11	86	29
1300	13	4000	40	8400	84	272	17	624	39	36	12	90	30
1400	14	4200	42	8600	86	288	18	640	40	38	13	94	31
1500	15	4400	44	8800	88	304	19	656	41	40	13	98	33
1600	16	4600	46	9000	90	320	20	672	42	42	14	102	34
1700	17	4800	48	9500	95	336	21	688	43	44	15	106	35
1800	18	5000	50	10000	100	352	22	704	44	46	15	110	37

Figure the cubic contents, exposed wall surface and glass surface of room to be heated, counting outside doors as glass. Under columns cubic contents, exposed wall and glass, locate the amounts corresponding to room measurements, and on the same line to the right is the amount of surface to heat the air and replace heat lost through walls and glass. Add these three amounts together and you have the number of square feet of radiation to heat the room to 70 degrees in zero weather.

For rooms on windward side increase radiation 10 per cent.

Note: The above figures are based on 12-inch brick walls, or best frame construction, with paper between plank and weather boards. For poor frame construction with badly fitted doors and windows, increase radiation 10 to 30 per cent, according to conditions.

For semi-direct work add 35 to 50 per cent. For indirect work add 50 to 75 per cent.



# DATA FOR THE FITTER

## Fitter's Guide

### For Figuring Hot Water Radiation

The formula under which the following tables were prepared has been used in the Northern states for fifteen years and can be recommended to those desiring the best results from the plants they install. Separate copies mailed upon application.

Cubic Contents of Room	Feet Radiation Required	Cubic Contents of Room	Feet Radiation Required	Cubic Contents of Room	Feet Radiation Required	Sq. Ft. Exposed Wall Surface	Feet Radiation Required	Sq. Ft. Exposed Wall Surface	Feet Radiation Required	Square Feet Glass Surface	Feet Radiation Required	Square Feet Glass Surface	Feet Radiation Required
350	6	1900	31	5200	86	10	1	230	23	4	2	48	24
400	7	2000	33	5400	90	20	2	240	24	6	3	50	25
450	8	2100	35	5600	93	30	3	250	25	8	4	52	26
500	8	2200	36	5800	96	40	4	260	26	10	5	54	27
550	9	2300	38	6000	100	50	5	270	27	12	6	56	28
600	10	2400	40	6200	103	60	6	280	28	14	7	58	29
650	11	2500	41	6400	106	70	7	290	29	16	8	60	30
700	12	2600	43	6600	110	80	8	300	30	18	9	62	31
750	13	2700	44	6800	113	90	9	310	31	20	10	64	32
800	14	2800	46	7000	116	100	10	320	32	22	11	66	33
850	14	2900	48	7200	120	110	11	330	33	24	12	68	34
900	15	3000	50	7400	123	120	12	340	34	26	13	70	35
950	16	3200	53	7600	126	130	13	350	35	28	14	74	37
1000	17	3400	56	7800	130	140	14	360	36	30	15	78	39
1100	18	3600	60	8000	133	150	15	370	37	32	16	82	41
1200	20	3800	63	8200	136	160	16	380	38	34	17	86	43
1300	21	4000	66	8400	140	170	17	390	39	36	18	90	45
1400	23	4200	70	8600	143	180	18	400	40	38	19	94	47
1500	25	4400	73	8800	146	190	19	420	42	40	20	98	49
1600	26	4600	76	9000	150	200	20	440	44	42	21	102	51
1700	28	4800	80	9500	158	210	21	460	46	44	22	106	53
1800	30	5000	83	10000	166	220	22	480	48	46	23	110	55

Figure the cubic contents, exposed wall surface and glass surface of room to be heated, counting outside doors as glass. Under columns cubic contents, exposed wall and glass, locate the amounts corresponding to room measurements, and on the same line to the right is the amount of surface to heat the air, and replace heat lost through walls and glass. Add these three amounts together and you have the number of square feet of radiation to heat the room to 70 degrees in zero weather.

For rooms on windward side increase radiation 10 per cent.

Note: The above figures are based on 12-inch brick walls, or best frame construction, with paper between plank and weather boards. For poor frame construction with badly fitted doors and windows, increase radiation 10 to 30 per cent, according to conditions.

For semi-direct work add 35 to 50 per cent. For indirect work add 50 to 75 per cent.

# Greenhouse Heating

Table of Amounts of Steam Radiating Surface Necessary to Heat a Given Amount of Glass Exposure to Various Temperatures in Zero Weather

Square Feet of Exposure	Steam					Square Feet of Exposure	Hot Water				
	No. of Square Feet of Radiation Required at						No. of Square Feet of Radiation Required at				
	40°	45°	50°	60°	70°		40°	45°	50°	60°	70°
25	27 56 8	31 61 9	34 71 10	41 81 13	5	25	41 8	5	61 13	71 14	81 16
50	56	61	71	81	10	50	8	10	13	14	16
75	8	9	10	13	15	75	13	15	19	21	25
100	11	13	14	17	20	100	17	20	25	29	33
200	23	25	30	33	40	200	33	40	50	57	67
300	34	38	43	50	60	300	50	60	75	86	100
400	45	50	57	67	80	400	67	80	100	114	133
500	56	63	72	83	100	500	83	100	125	143	167
1000	112	125	143	167	200	1000	167	200	250	286	333
2000	223	250	286	333	400	2000	333	400	500	572	667
3000	334	375	429	500	600	3000	500	600	750	857	1000
4000	445	500	571	667	800	4000	667	800	1000	1143	1333
5000	556	625	714	833	1000	5000	833	1000	1250	1429	1667
10000	1112	1250	1429	1667	2000	10000	1667	2000	2500	2857	3333
20000	2223	2500	2857	3333	4000	20000	3333	4000	5000	5714	6667

For poorly constructed houses add 10 per cent to the foregoing amounts.  
 Note: Above information quoted from standard authorities—not guaranteed.

## Testing the Heating System at Various Outside Temperatures

Temperature Outside Air	Co-efficient-x Heat per Square Foot per Hour per Degree	Total Heat per Square Foot per Hour	Resulting Temperature of Room	Difference Temperature Radiator and Room
10	1.85	288.	64.7	155.3
0	1.8	270.	70.	150.
10	1.75	253.	75.1	144.9
20	1.7	236.	81.	139.
30	1.65	218.	86.5	133.5
40	1.6	203.	93.1	128.0
50	1.55	188.	98.7	122.5
60	1.5	172.	104.7	116.5
70	1.45	158.	110.5	109.5
80	1.4	142.	117.1	102.9
90	1.35	130.5	123.5	96.5
100	1.3	117.	130.3	89.7

Example Showing Application of Table— To determine by a test of the apparatus, when weather is 60 degrees, whether a guarantee to heat to 70 degrees in zero weather is maintained, operate the apparatus as though in regular use and note the average temperature of the room. If the room has a temperature equal to or in excess of 104.7 degrees F., it would have a temperature of 70 degrees in zero weather, all other conditions, such as wind, position of windows, etc., being the same as on the day of the test.

This table, although calculated for steam with radiator at temperature of 220 degrees F., is practically correct for hot-water radiation or for steam at any pressure and temperature.

x-Value of  $c'$  in formulae.

Note: Above information quoted from standard authorities—not guaranteed.

## Heat Values

Highest evaporation tests of free burning and caking soft coals, selected from tests made by U. S. Bureau of Mines.

State	County	Name	B. T. U. per Lb.
Alabama	Jefferson	Pratt	15605
Arkansas	Sebastian	Bache-Denman	15484
Colorado	Gunnison	Ruby	15320
Georgia	Walker	Durham	15678
Illinois	Ledford	Premium	14752
Indiana	Green	Jasonville & Midland	14606
Indian Territory	.....	.....	14682
Kansas	Mineral	Cherokee	15002
Kentucky	Belle	Straight Creek	15143
Maryland	Allegheny	George's Creek	15644
Michigan	Saginaw	Riverside	14591
Missouri	Randolph	.....	11747
Montana	Colfax	Dawson	15092
New Mexico	Colfax	.....	13059
North Dakota	Williams	.....	12100
Ohio	Athens	Eclipse	15121
Oklahoma	Le Flore	Bokoshe	15503
Pennsylvania	Somerset	Orenda	15744
Tennessee	Anderson	Crass Mountain	15194
Texas	Maverick	Eagle Pass	14381
Utah	Emery	King	14557
Virginia	Tazewell	Pocahontas	15785
Washington	Pierce	Gale Creek	15449
West Virginia	McDowell	Pocahontas	15844
Wyoming	Lincoln	Kamerer	14601

## Anthracite or "Hard" Coal Sizes

The ordinary sizes and designations of "Domestic" hard coals are:

Names of Sizes	Will Pass Through	Will Not Pass Through
"Pea" .....	$\frac{3}{4}$ inch mesh	$\frac{1}{2}$ inch mesh
"Chestnut" or "Nut" .....	$1\frac{1}{4}$ inch mesh	$\frac{3}{4}$ inch mesh
"Stove" or "Range" .....	$1\frac{3}{4}$ inch mesh	$1\frac{1}{4}$ inch mesh
"Egg"—in the East .....	$2\frac{1}{2}$ inch mesh	$1\frac{3}{4}$ inch mesh
"Large Egg"—Chicago .....	4 inch mesh	$2\frac{3}{4}$ inch mesh
"Small Egg"—Chicago .....	$2\frac{3}{4}$ inch mesh	2 inch mesh
"Broken" or "Grate" .....	4 inch mesh	$2\frac{1}{2}$ inch mesh



## Bituminous or "Soft" Coal Sizes

For "Domestic" soft coals there are no uniform names and sizes; but they are marketed in the various states under about these classes; "Screenings" usually smallest sizes.

"Duff" goes through  $\frac{1}{8}$  inch screen.

"No. 3 Nut" goes through  $1\frac{1}{4}$  inch screen, over  $\frac{3}{4}$  inch screen.

"No. 2 Nut" goes through 2 inch screen, over  $1\frac{1}{4}$  inch screen.

"No. 1 Domestic Nut" goes through 3 inch screen, over  $1\frac{1}{2}$  or 2 inch screen.

"No. 4 Washed" goes through  $\frac{3}{4}$  inch screen, over  $\frac{1}{4}$  inch screen.

"No. 3 Washed Chestnut" goes through  $1\frac{1}{4}$  inch screen, over  $\frac{3}{4}$  inch screen.

"No. 2 Washed Stove" goes through 2 inch screen, over  $1\frac{1}{4}$  inch screen.

"No. 1 Washed Egg" goes through 3 inch screen, over 2 inch screen.

"No. 3 Roller Screened Nut" goes through  $1\frac{1}{2}$  inch screen, over 1 inch screen.

"No. 2 Roller Screened Nut" goes through 2 inch screen, over  $1\frac{1}{2}$  inch screen.

"No. 1 Roller Screened Nut" goes through  $3\frac{1}{2}$  inch screen, over 2 inch screen.

"Egg" goes through 6 inch screen, over 3 inch screen.

"Lump" or "Block" goes through 6 inch screen, or over.

"Run-of-Mine" in fine and large lumps.

**Pocahontas Smokeless:** Generally sized as: "Nut," "Egg," "Lump," and "Mine-Run."

**Cannel Coal:** For fireplaces.—"Hand Picked Lump;" for stoves:—"Egg."

**Domestic By-Product Coke:** "Egg" 3 in. -  $2\frac{1}{2}$  in.

"Large Stove"  $2\frac{1}{2}$  in. - 2 in. "Small Stove" 2 in. -  $1\frac{1}{2}$  in.

"Nut"  $1\frac{1}{2}$  in. -  $\frac{3}{4}$  in. "Pea"  $\frac{3}{4}$  in. -  $\frac{1}{2}$  in.

## Combustion of Coal and Oil

Volumes of Chemically Required Air Given in the Two Columns at Right		Weight of Air Required, Lbs.	
<b>Carbon</b>		For Coal	For Oil
Coal 11.6 lb. air X 0.8226 lb. C.....		9.54	.....
Oil, 11.6 lb. air X 0.8764 lb. C.....		.....	10.16
<b>Hydrogen</b>			
Coal, 34.8 lb. air X 0.0389 lb. H.....		1.35	.....
Oil 34.8 lb. air X 0.104 lb. H.....		.....	3.62
<b>Sulphur</b>			
Coal, 4.3 lb. air X 0.0049 lb. S.....		0.02	.....
Oil, 4.3 lb. air X 0.010 lb. S.....		.....	0.04
Lbs. of air required.....		10.91	13.82
Weight of the combustibles (after deducting ash from coal).....		0.91	1.00
Total weight which will be considered as dry chimney gas.....		11.82	14.82

Proceedings of American Society of Mechanical Engineers.

## Composition and Heat Values of Anthracite Coals

Locality	Fixed Car- bon	Vola- tile	Mois- ture	Ash	Sul- phur	B. T. U. per Lb. of Dry Coal
<b>Anthracite</b>						
Pennsylvania.....	78.60	.....	.....	14.80	0.40	.....
Pennsylvania Buckwheat.....	81.32	3.84	3.88	10.96	0.67	12,200
Pennsylvania, Wilkesbarre.....	76.94	6.42	1.34	15.30	.....	11,801
Pennsylvania, Scranton.....	79.23	3.73	3.33	13.70	.....	12,149
Pennsylvania, Scranton.....	84.46	5.37	0.97	9.20	.....	12,294
Pennsylvania Cross Creek.....	89.19	1.96	3.62	5.23	.....	13,723
Pennsylvania Lehigh Valley.....	75.20	7.36	1.44	16.00	.....	12,423
Pennsylvania, Lykens Valley.....	76.94	6.21	.....	.....	.....	15,300
Pennsylvania, Lykens Valley ..	81.00	5.00	.....	.....	.....	15,300
Pennsylvania, Wharton.....	86.40	3.08	3.71	6.22	0.58	15,000
Pennsylvania, Buck Mt.....	82.66	3.95	3.04	9.88	0.46	15,070
Pennsylvania, Beaver Meadow.....	88.94	2.38	1.50	7.11	1.01	.....
Pennsylvania Lackawanna.....	87.74	3.91	2.12	6.35	0.12	.....
Rhode Island.....	85.00	.....	.....	7.00	0.90	.....
Arkansas.....	74.49	14.73	1.52	9.26	.....	13,217
<b>Semi-Anthracite</b>						
Pennsylvania, Loyalsock.....	83.34	8.10	1.30	6.23	1.03	15,400
Pennsylvania, Bernice.....	82.52	3.56	0.96	3.27	0.24	15,050
Pennsylvania Bernice.....	89.39	8.56	0.97	9.34	1.04	15,475
Pennsylvania, Wilkesbarre.....	88.90	7.68	.....	3.49	.....	14,199
Pennsylvania, Lycoming Creek.....	71.53	13.84	0.67	13.96	0.03	.....
Virginia, Natural Coke.....	75.08	12.44	1.12	11.38	0.47	.....
Arkansas.....	74.06	14.93	1.35	9.66	.....	.....
Indian Territory.....	73.21	13.65	5.11	8.03	1.18	13,662
Maryland, Easby.....	83.60	16.40	.....	.....	.....	11,207

## Classification of Coals

Kind of Coal	Composition per Pound of Combustible		Calorific Value per Pound of Combustible B. T. U.
	Volatile Matter Per Cent	Fixed Carbon Per Cent	
Anthracite.....	3.0- 7.5	97.0-92.5	14,900-15,300
Semi-anthracite.....	7.5-12.5	92.5-87.5	15,300-15,600
Semi-bituminous.....	12.5-25.0	87.5-75.0	15,600-15,900
Bituminous—Eastern.....	25.0-40.0	75.0-60.0	14,800-15,800
Bituminous—Western.....	35.0-40.0	65.0-50.0	13,700-15,200
Cannel—Eastern.....	45. -60. -	.....	15,700-16,200
Lignite.....	27. -60. -	.....	9,600-13,250

## Heat Values of Miscellaneous Fuels

Wood, Hard.....	B. T. U. per pound.....	8,510
Wood, Soft.....	B. T. U. per pound.....	8,700
Crude Petroleum.....	B. T. U. per pound.....	17,590
Kerosene.....	B. T. U. per pound.....	19,643
Benzine.....	B. T. U. per pound.....	19,500
Gasoline.....	B. T. U. per pound.....	19,780
Naphtha.....	B. T. U. per pound.....	19,995
Acetylene.....	B. T. U. per cubic foot.....	1,551
Ethylene.....	B. T. U. per cubic foot.....	1,673
Methane.....	B. T. U. per cubic foot.....	1,065
Ethane.....	B. T. U. per cubic foot.....	1,858
Propene.....	B. T. U. per cubic foot.....	2,654
Butane.....	B. T. U. per cubic foot.....	3,415
Pentane.....	B. T. U. per cubic foot.....	4,250
Hexane.....	B. T. U. per cubic foot.....	5,012
Propylene.....	B. T. U. per cubic foot.....	2,509
Butylene.....	B. T. U. per cubic foot.....	3,300
Carbon Monoxide.....	B. T. U. per cubic foot.....	349
Hydrogen.....	B. T. U. per cubic foot.....	348
Coal Gas.....	B. T. U. per cubic foot.....	680
Natural Gas.....	B. T. U. per cubic foot.....	1,000
Producer Gas.....	B. T. U. per cubic foot.....	145
Carbureted Water Gas.....	B. T. U. per cubic foot.....	525 to 675
Water Gas.....	B. T. U. per cubic foot.....	300

## Composition and Calorific Value of Various Oils

Kind of Oil	Per Cent Car- bon	Per Cent Hydro- gen	Per Cent Sul- phur	Per Cent Oxy- gen	Spe. Grav- ity	Deg. Flash Point	B. t. u. Pound	Authority
#California ..	85.04	11.52	2.45	0.99*	.....	.....	17871	B.&W. Co.
California...	81.52	11.51	0.55	6.92*	.....	230	18667	U. S. N. Liquid Fuel Board
Texas.....	87.15	12.33	0.32	.....	0.908	370	19388	U. S. N.
Texas.....	87.29	12.32	0.43	.....	0.910	375	19659	U. S. N.
Ohio.....	83.40	14.70	0.60	1.30	.....	.....	19580	.....
Pennsylvania	84.90	13.70	.....	1.40	0.886	.....	19210	Booth
West Virginia	84.30	14.10	.....	1.60	0.841	.....	21240	.....

\*Includes N.

#Per cent moisture = 1.40

The comparative value of petroleum and coal as fuel may be summed up to the advantage of the liquid fuel as follows: The cost of handling is much lower, both in delivery and in burning same, while for equal heat value much less storage space is required, and this space may be at a distance from the boilers. Higher efficiencies are obtainable, since the combustion is more perfect, less excess air is required, temperatures are more constant, and since smoke is largely eliminated the heating surfaces are correspondingly clean.

# DATA FOR THE FITTER

## COST OF HEATING WITH GAS AND OIL COMPARED WITH COAL

Coal Cost per short ton (1 lb. = 12500 B. T. U.)	Gas 1 cu. ft. = 600 B. T. U. cost per thousand cu. ft.			Gas 1 cu. ft. = 1000 B. T. U. cost per thousand cu. ft.			Oil 1 lb. = 19000 B. T. U. cost per gallon		
Dollars	.30	.50	.70	.30	.50	.70	.06	.09	.12
3.00	4.17	5.55	9.72	2.50	4.17	5.83	3.44	5.15	6.87
4.00	3.12	5.21	7.29	1.88	3.12	4.37	2.57	3.86	5.14
5.00	2.50	4.17	5.83	1.50	2.50	3.50	2.06	3.09	4.12
6.00	2.08	3.47	4.86	1.25	2.08	2.92	1.72	2.58	3.44
7.00	1.79	2.98	4.17	1.07	1.78	2.50	1.47	2.21	2.95
8.00	1.56	2.60	3.65	.94	1.56	2.19	1.29	1.93	2.58
9.00	1.39	2.32	3.24	.83	1.39	1.94	1.15	1.72	2.29
10.00	1.25	2.08	2.92	.75	1.25	1.75	1.03	1.55	2.06
11.00	1.14	1.52	2.65	.68	1.14	1.59	.94	1.41	1.88
12.00	1.04	1.74	2.43	.63	1.04	1.46	.86	1.29	1.72
15.00	.83	1.11	1.94	.50	.83	1.16	.69	1.03	1.37

The above table is computed with the assumption that the efficiency of utilization is the same for coal, gas and oil.

For example, in comparing the heating cost of gas of 600 B. T. U. at 70 cents and coal at \$9.00 per ton, it would cost 3.24 times as much to heat with gas as with coal.

If the operating efficiency of the boilers is unequal correction may be made by multiplying the table factor by the ratio of the efficiencies.

## AVERAGE WEIGHT OF COAL

One cubic foot of hard coal weighs about.....50 pounds  
One cubic foot of soft coal weighs about.....40 pounds  
One cubic foot of coke weighs about.....28 pounds

## CO<sup>2</sup> LOSS IN GAS-FIRED BOILERS

Per Cent of Preventable Loss				Cost at 12½ per M per Million Cubic Feet			
Per Cent CO²	Temp. Flue Gas	400°	500°	600°	400°	500°	600°
14.....	0	.....	.....	.....	0	0	0
13.....	.82	1.0	1.2	1.02	1.25	1.50	
12.....	1.8	2.3	2.8	2.25	2.87	3.50	
11.....	3.0	3.7	4.5	3.75	4.62	5.62	
10.....	4.5	5.6	6.8	5.62	7.00	8.50	
9.....	5.9	7.4	9.0	7.40	9.25	11.25	
8.....	8.5	10.7	12.8	10.62	13.37	16.00	
7.....	11.6	13.5	16.3	14.50	16.87	20.37	
6.....	14.3	17.9	21.6	17.87	22.37	27.00	
5.....	19.2	24.1	29.0	24.00	30.12	36.25	
4.....	27.9	34.8	42.1	34.87	43.50	52.62	
3.....	40.5	51.0	61.3	50.62	63.75	76.60	

Carbon is the main element in all fuels; by following the changes in carbon during combustion we may determine the heat to be obtained by any fuel.

If one atom of C be burned with two atoms of O we get complete combustion of the C, or CO<sup>2</sup>. This reaction gives off 14,650 B. T. U's. One atom of carbon burns one atom of oxygen, which equals CO, and a heat of 4,400 B. T. U's. Hydrogen unites with oxygen, forming H<sub>2</sub>O; with a heat value of 62,100 B. T. U's.

The oxygen for combustion is taken from the air, which has the composition:.

By weight { N = 0.768                      By volume { O = 0.2094  
                  { O = 0.232    { N = 0.7906

Note: Above information quoted from standard authorities—not guaranteed.



## Analysis of Commercial Gases (By Volume)

Name	H	CH <sup>4</sup>	C <sup>2</sup> H <sup>4</sup>	N	CO	O	CO <sup>2</sup>	B. T. U. Cubic Feet	O Required for Combustion	Air for Combustion
Natural gas (Okla.)...	...	75.0	13.0	10.0	...	0.5	1.50	975.0	1.87	9.38
Natural gas (Pitts.)...	3.0	92.0	3.0	2.0	...	...	...	978.0	1.94	9.73
Oil gas.....	32.0	48.0	16.5	3.0	...	0.5	...	846.0	1.61	8.07
Coal or bench gas....	46.0	40.0	5.0	2.0	6.0	0.5	0.5	646.0	1.21	6.05
Coke-oven gas.....	50.0	36.0	4.0	2.0	6.0	0.5	1.5	603.0	1.12	5.60
Carbureted water gas	40.0	25.0	8.5	4.0	19.0	0.5	3.0	575.0	1.05	5.25
Water gas.....	48.0	2.0	...	5.5	38.0	0.5	6.0	295.0	0.47	2.35
Producer-gas from hard coal.....	20.0	...	...	49.5	25.0	0.5	5.0	144.0	0.22	1.12
Producer-gas from soft coal.....	10.0	3.0	0.5	58.0	23.0	0.5	5.0	144.0	0.24	1.20
Producer-gas from coke	10.0	...	...	56.0	29.0	0.5	4.5	125.0	0.19	0.98
Blast-furnace gas.....	1.0	...	...	60.0	27.5	...	11.5	91.0	0.143	0.72
Blau gas.....	2.5	52.0	44.0	...	...	...	...	1800.0	2.49	12.5

## Flow of Gas in Pipes

Modified Unwin's Formula	Size	K
$h = Q \frac{LWgZ}{7D}$ , $Z = .044(1 + \frac{1}{D})$	$\frac{3}{8}$	3
	$\frac{1}{2}$	6
	$\frac{3}{4}$	14
$h$ = pressure drop in inches of water	1	28
$Q$ = discharge in cubic feet per minute	$1\frac{1}{4}$	59
	$1\frac{1}{2}$	93
$Q$ = discharge in cubic feet per hour	2	170
	4	1070
$Wg$ = wgt. of gas lbs. per cu. ft.	6	3120
$S$ = Sp. Gr. (Air = 1) = $\frac{Wg}{.076}$	8	6570
	10	11700
	12	18700
	16	38800
$L$ = length in feet	20	68100
$D$ = diameter in feet	24	109000
$K$ = Conductivity when $S$ is .5	30	192000
$H$ is $1/10$ and $I$ is 1000 feet.	36	305000
	42	450000
	48	622000

Note: Above information quoted from standard authorities—not guaranteed.

# DATA FOR THE FITTER

## Capacity per Hour, in Cubic Feet, of Thin Orifices, Similar to Openings in Air and Gas Mixers at Different Pressures

Ounces	Tenths of Water	Tenths of Mercury	$\frac{5}{64}$	$\frac{3}{32}$	$\frac{7}{64}$	$\frac{1}{12}$	$\frac{5}{32}$	$\frac{6}{32}$	$\frac{3}{16}$
.12	2.	.15	4	6	8	10	16	22	40
.23	4.	.29	6	8	12	15	23	34	60
.35	6.	.44	7	10	14	18	28	40	76
.46	8.	.59	8	12	16	21	33	47	84
.58	10.	.73	9	13	18	23	36	52	92
.69	12.	.88	10	14	19	25	39	56	100
.79	13.7	1.00	11	15	21	27	42	61	108
.81	14.	1.04	11	15	21	27	42	61	108
.92	16.	1.19	11	15	22	29	47	67	120
1.04	18.	1.33	12	17	24	31	48	69	124
1.15	20.	1.47	13	18	25	33	51	74	132
1.44	25.	1.83	14	20	28	36	56	81	144
1.58	27.3	2.00	15	21	29	38	59	85	152
2.00	35.6	2.61	17	24	33	43	67	97	172
2.38	40.9	3.00	18	26	36	47	73	106	188
3.16	54.6	4.00	21	30	42	54	84	121	216
3.95	68.2	5.00	23	34	46	60	94	135	240
4.73	81.9	6.00	26	37	51	66	103	148	264
5.52	95.5	7.00	28	40	55	71	111	160	284
6.31	109.2	8.00	30	43	59	76	119	171	304
7.10	122.8	9.00	31	45	61	80	125	180	320
7.89	136.5	10.00	33	48	65	85	133	191	340
8.68	150.1	11.00	35	50	69	89	139	200	356
9.46	163.7	12.00	36	52	72	93	145	209	372
10.25	177.4	13.00	38	55	75	98	153	220	392
11.04	191.1	14.00	39	57	78	101	158	227	404
11.83	204.7	15.00	41	58	80	104	162	234	416
12.62	218.3	16.00	42	60	83	108	168	243	432
13.41	232.0	17.00	43	62	85	111	173	250	444
14.20	245.6	18.00	44	64	88	114	178	256	456
14.99	259.3	19.00	46	66	90	117	183	263	468
15.78	273.0	20.00	48	68	93	121	189	272	484

Note: Above information quoted from standard authorities—not guaranteed.

# Wrought Iron Welded Steam, Gas, and Water Pipe

Table of Standard Dimensions

Diameter			Thick- ness	Circumference		Transverse Areas			Length of Pipe per Sq. Ft. of		Length of Pipe Contain- ing One Cu. Ft.	Nomi- nal Weight per Foot	No. of Threads per Inch of Screw	Tap Drill
Nominal Internal	Actual Exter- nal	Actual Inter- nal		Exter- nal	Inter- nal	Exter- nal	Inter- nal	Metal	Exter- nal Surface	Inter- nal Surface				
Inches	Inches	Inches	Inches	Inches	Inches	Sq. In.	Sq. In.	Sq. In.	Feet	Feet	Feet	Lbs.		
1/8	.405	.27	.068	1.272	.848	.129	.0573	.0717	9.44	14.15	2513.	.241	27	11/32
1/4	.54	.364	.088	1.696	1.144	.229	.1041	.1249	7.075	10.49	1383.3	.42	18	7/16
3/8	.675	.494	.091	2.121	1.552	.358	.1917	.1663	5.657	7.73	751.2	.559	18	9/16
1/2	.84	.623	.109	2.639	1.957	.554	.3048	.2492	4.547	6.13	472.4	.837	14	11/16
5/8	1.05	.824	.113	3.299	2.589	.866	.5333	.3327	3.637	4.635	270.	1.115	14	13/16
1	1.315	1.048	.134	4.131	3.292	1.358	.8626	.4954	2.904	3.645	166.9	1.668	11 1/2	1 1/8
1 1/8	1.66	1.38	.14	5.215	4.335	2.164	1.496	.668	2.301	2.768	96.25	2.244	11 1/2	1 1/2
1 1/4	1.9	1.611	.145	5.969	5.061	2.835	2.038	.797	2.01	2.371	70.66	2.678	11 1/2	1 3/4
1 1/2	2.375	2.067	.154	7.461	6.494	4.43	3.356	1.074	1.608	1.848	42.91	3.609	11 1/2	2 1/4
2	2.875	2.468	.204	9.032	7.753	6.492	4.784	1.708	1.328	1.547	30.1	5.739	8	2 1/2
2 1/2	3.5	3.067	.217	10.996	9.636	9.621	7.388	2.243	1.091	1.245	19.5	7.536	8	2 3/4
3	4.	3.548	.226	12.566	11.146	15.904	12.73	2.679	.955	1.077	14.57	9.001	8	3 1/8
3 1/2	4.5	4.026	.237	14.137	12.648	15.904	12.73	3.174	.849	.949	11.31	10.665	8	3 1/2
4	5.	4.508	.246	15.708	14.162	19.635	15.961	3.674	.764	.848	9.02	12.34	8	4 1/8
4 1/2	5.563	5.045	.259	17.477	15.849	24.306	19.99	4.316	.687	.757	7.2	14.502	8	4 1/2
5	6.625	6.065	.28	20.813	19.054	34.472	28.888	5.584	.577	.63	4.98	18.762	8	5
6	7.625	7.023	.301	23.955	22.063	45.664	38.738	6.926	.501	.544	3.72	23.271	8	6
7	8.625	7.982	.322	27.096	25.076	58.426	50.04	8.386	.443	.478	2.88	28.177	8	7
8	9.625	8.937	.344	30.238	28.076	72.76	62.73	10.03	.397	.427	2.29	33.701	8	8
9	10.75	10.019	.366	33.772	31.477	90.763	78.839	11.924	.355	.382	1.82	40.065	8	9

Note: Above information quoted from standard authorities—not guaranteed.

## Square Feet of Radiating Surface of Pipe per Lineal Foot

On all lengths over one foot, fractions less than tenths are added to or dropped.

Length of Pipe	Size of Pipe									
	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	4	5	6
1	.275	.346	.434	.494	.622	.753	.916	1.175	1.455	1.739
2	.5	.7	.9	1.	1.2	1.5	1.8	2.4	2.9	3.5
3	.8	1.	1.3	1.5	1.9	2.3	2.7	3.5	4.4	5.2
4	1.1	1.4	1.7	2.	2.5	3.	3.6	4.7	5.8	7.
5	1.4	1.7	2.2	2.4	3.1	3.8	4.6	5.8	7.3	8.7
6	1.6	2.1	2.6	2.9	3.7	4.5	5.5	7.	8.7	10.5
7	1.9	2.4	3.	3.4	4.4	5.8	6.4	8.2	10.2	12.1
8	2.2	2.8	3.5	3.9	5.	6.	7.3	9.4	11.6	13.9
9	2.5	3.1	3.9	4.4	5.6	6.8	8.2	10.6	13.1	15.7
10	2.7	3.5	4.3	4.9	6.2	7.5	9.1	11.8	14.6	17.4
11	3.	3.8	4.8	5.4	6.8	8.3	10.	12.9	16.	19.1
12	3.3	4.1	5.2	5.9	7.5	9.	11.	14.1	17.4	20.9
13	3.6	4.5	5.6	6.4	8.1	9.8	11.9	15.3	18.9	22.6
14	3.8	4.8	6.1	6.9	8.7	10.5	12.8	16.5	20.3	24.3
15	4.1	5.2	6.5	7.4	9.3	11.3	13.7	17.6	21.8	26.1
16	4.4	5.5	6.9	7.9	10.	12.	14.6	18.8	23.2	27.8
17	4.7	5.9	7.4	8.4	10.6	12.3	15.5	20.	24.7	29.5
18	5.	6.2	7.8	8.9	11.2	13.5	16.5	21.2	26.2	31.3
19	5.2	6.6	8.3	9.4	11.8	14.3	17.4	22.3	27.6	33.1
20	5.5	6.9	8.7	9.9	12.5	15.	18.3	23.5	29.1	34.8
21	5.8	7.3	9.1	10.4	13.	15.8	19.2	24.7	30.5	36.5
22	6.	7.6	9.6	10.9	13.7	16.5	20.2	25.9	32.	38.3
23	6.3	8.	10.	11.3	14.3	17.3	21.1	27.	33.5	40.
24	6.6	8.3	10.4	11.9	14.9	18.	22.	28.2	34.9	41.7
25	6.9	8.6	10.9	12.3	15.6	18.8	22.9	29.3	36.4	43.5
26	7.1	9.	11.3	12.8	16.2	19.5	23.8	30.5	37.8	45.2
27	7.4	9.4	11.7	13.3	16.8	20.3	24.7	31.7	39.3	47.
28	7.7	9.7	12.2	13.8	17.4	21.	25.6	32.9	40.7	48.7
29	8.	10.	12.6	14.3	18.0	21.8	26.6	34.1	42.2	50.4
30	8.3	10.4	13.	14.8	18.7	22.5	27.5	35.3	43.6	52.1
31	8.5	10.7	13.5	15.3	19.3	23.3	28.4	36.4	45.1	53.9
32	8.8	11.1	13.9	15.8	19.9	24.1	29.3	37.6	46.5	55.6
33	9.1	11.4	14.3	16.3	20.5	24.8	30.2	38.8	48.	57.4
34	9.4	11.7	14.7	16.8	21.2	25.6	31.1	40.	49.5	59.1
35	9.6	12.1	15.2	17.3	21.8	26.3	32.	41.1	50.9	60.8
36	9.9	12.5	15.6	17.8	22.4	27.	33.	42.3	52.4	62.6
37	10.2	12.8	16.1	18.3	23.0	27.8	33.9	43.5	53.8	64.3
38	10.5	13.2	16.5	18.8	23.7	28.5	34.8	44.6	55.2	66.
39	10.7	13.5	16.9	19.3	24.3	29.3	35.7	45.8	56.7	67.8
40	11.	13.8	17.4	19.8	24.9	30.1	36.6	47.	58.2	69.5
41	11.3	14.2	17.8	20.3	25.5	30.8	37.6	48.2	59.6	71.3
42	11.5	14.5	18.2	20.8	26.1	31.6	38.5	49.4	61.1	73.
43	11.8	14.9	18.7	21.3	26.8	32.3	39.4	50.6	62.5	74.8
44	12.1	15.2	19.1	21.8	27.4	33.1	40.3	51.7	64.	76.5
45	12.4	15.6	19.5	22.2	28.	33.8	41.2	52.9	65.5	78.2
46	12.7	15.9	20.0	22.7	28.6	34.6	42.2	54.	67.	80.
47	12.9	16.3	20.4	23.2	29.2	35.3	43.	55.2	68.4	81.7
48	13.2	16.6	20.8	23.7	29.9	36.1	43.9	56.4	69.8	83.5
49	13.5	17.	21.3	24.2	30.5	36.8	44.8	57.6	71.2	85.1
50	13.8	17.3	21.7	24.7	31.1	37.6	45.8	58.7	72.7	87.

Note: Above information quoted from standard authorities—not guaranteed.



# DATA FOR THE FITTER

## Table Showing Expansion of Wrought Iron Pipe

Initial	Increase in Length per 100 Feet when Heated to									
Temperature	160°	180°	200°	212°	228°	240°	250°	259°	267°	274°
Zero, in.	1.28	1.44	1.60	1.69	1.82	1.92	2.00	2.07	2.13	2.20
32° in.	1.02	1.18	1.34	1.43	1.56	1.66	1.74	1.81	1.87	1.94
64° in.	.77	.93	1.09	1.18	1.31	1.41	1.49	1.56	1.61	1.69
	Hot Water			Water Boils	5 lbs.	10 lbs.	15 lbs.	20 lbs.	25 lbs.	30 lbs.

Wrought iron pipe expands, in inches, per 100 feet, 4-5 of the increase in temperature of steam or water it is subjected to, over the temperature at the time of installation, divided by 100.

Example—Temperature when installed, 32°, 10 lbs. pressure =240°, difference 208°, 4-5 of which equals 1 66-100 inches expansion per 100 feet.

## Decimal Equivalents of Fractions

Frac- tion	Dec. Equiv.	Frac- tion	Dec. Equiv.	Frac- tion	Dec. Equiv.	Frac- tion	Dec. Equiv.
1/64	0.015625	17/64	0.265625	33/64	0.515625	49/64	0.765625
1/32	0.031250	9/32	0.281250	17/32	0.531250	25/32	0.781250
3/64	0.046875	19/64	0.296875	35/64	0.546875	51/64	0.796875
1/16	0.062500	5/16	0.312500	9/16	0.562500	13/16	0.812500
5/64	0.078125	21/64	0.328125	37/64	0.578125	53/64	0.828125
3/32	0.093750	11/32	0.343750	19/32	0.593750	27/32	0.843750
7/64	0.109375	23/64	0.359375	39/64	0.609375	55/64	0.859375
1/8	0.125000	3/8	0.375000	5/8	0.625000	7/8	0.875000
9/64	0.140625	25/64	0.390625	41/64	0.640625	57/64	0.890625
5/32	0.156250	13/32	0.406250	21/32	0.656250	29/32	0.906250
11/64	0.171875	27/64	0.421875	43/64	0.671875	59/64	0.921875
3/16	0.187500	7/16	0.437500	11/16	0.687500	15/16	0.937500
13/64	0.203125	29/64	0.453125	45/64	0.703125	61/64	0.953125
7/32	0.218750	15/32	0.468750	23/32	0.718750	37/32	0.968750
15/64	0.234375	31/64	0.484375	47/64	0.734375	63/64	0.984375
1/4	0.250000	1/2	0.500000	3/4	0.750000	1	1.000000

Note: Above information quoted from standard authorities—not guaranteed.

## Pipe Sizes for Supply and Return Lines (Steam)

Pipe Size, Inches .....	$\frac{1}{2}$	$\frac{3}{4}$	1	1 $\frac{1}{4}$	1 $\frac{1}{2}$	2	2 $\frac{1}{2}$
Supply mains, all systems, downfeed risers, all systems...			40	80	150	300	500
Upfeed risers, one-pipe systems				50	100	200	300
Return lines, two-pipe and vapor systems.....		50	150	300	900	2000	3800
Vacuum return lines.....	100	400	800	1500	3000	6000	10000

Pipe Size, Inches .....	3	3 $\frac{1}{2}$	4	5	6	8	10
Supply mains, all systems, downfeed risers, all systems...	800	1200	1600	3000	4800	10000	15000
Upfeed risers, one-pipe systems	500	700	800	1300	1800	3000	.....
Return lines, two-pipe and vapor systems.....	6000	10000	13000	23000	37000	78000	.....
Vacuum return lines.....	18000	30000	40000	65000	.....	.....	.....

Vapor and vacuum systems, supply  $\frac{3}{4}$  inch, return  $\frac{1}{2}$  inch.

The size of pipe actually required to convey the necessary amount of steam is usually considerably less than these arbitrary sizes.

## Area of Pipes and Their Equivalents

Main	Branches
1 in. will supply.....	2 $\frac{3}{4}$ -in.
1 $\frac{1}{4}$ in. will supply.....	2 1-in.
1 $\frac{1}{2}$ in. will supply.....	2 1 $\frac{1}{4}$ -in.
2 in. will supply.....	2 1 $\frac{1}{2}$ -in.
2 $\frac{1}{2}$ in. will supply.....	2 1 $\frac{3}{4}$ -in. and 1 1 $\frac{1}{4}$ -in., or 1 2-in. and 1 1 $\frac{1}{4}$ -in.
3 in. will supply.....	1 2 $\frac{1}{2}$ -in. and 1 2-in., or 2 2-in. and 1 1 $\frac{1}{2}$ -in.
3 $\frac{1}{2}$ in. will supply.....	2 2 $\frac{1}{2}$ -in. or 1 3-in. and 1 2-in. or 3 2-in.
4 in. will supply.....	1 3 $\frac{1}{2}$ -in. and 1 2 $\frac{1}{2}$ -in., or 2 3-in., or 4 2-in.
4 $\frac{1}{2}$ in. will supply.....	1 3 $\frac{3}{4}$ -in., 1 3-in., or 1 4-in. and 1 2 $\frac{1}{2}$ -in.
5 in. will supply.....	1 4-in., and 1 3-in., or 1 4 $\frac{1}{2}$ -in. and 1 2 $\frac{1}{2}$ -in.
6 in. will supply.....	2 4-in. and 1 3-in., or 4 3-in. and 1 2-in.
7 in. will supply.....	1 6-in. and 1 4-in., or 3 4-in. and 1 2-in.
8 in. will supply.....	2 6-in. and 1 5-in., or 5 4-in. and 2 2-in.

Note: Above information quoted from standard authorities—not guaranteed.

## DATA FOR THE FITTER

### Sizes of Mains (Water)

**Capacity of Mains of Various Pipe Sizes for Different Kinds of Systems**

Assumed Length 100 Feet, Temperature Drop in Radiator 20°

Pipe Diameter, Inches	Capacity Square Feet of Direct Radiation		
	Two-pipe Upfeed	One-pipe Upfeed	Overhead
1¼	75	45	130
1½	110	65	190
2	200	121	340
2½	310	190	530
3	540	330	920
3½	780	470	1,330
4	1,100	650	1,800
5	1,900	1,100	3,200
6	3,000	1,800	5,000
7	4,300	2,700	7,200
8	5,900	3,500	9,900

### Size of Risers (Water)

**Capacity of Risers in Square Feet of Radiation**

Assumed Temperature Drop in Radiators 20°

Pipe Size Inches	Upfeed				Downfeed Risers Not Exceeding Four Floors
	First Floor	Second Floor	Third Floor	Fourth Floor	
1	33	46	57	64	48
1¼	71	104	124	142	112
1½	100	140	175	200	160
2	187	262	325	375	300
2½	292	410	492	580	471
3	500	755	875	1,000	810

### Relative Effect of Radiator Paints

Kind of Paint	Relative Transmission
Bare iron surface	1.000
Copper bronze	0.760
Aluminum bronze	0.752
Snow-white enamel	1.010
No-luster green enamel	0.956
Terra-cotta enamel	1.038
Maroon glass Japan	0.997
White lead paint	0.987
White zinc paint	1.010

Note: Above information quoted from standard authorities—not guaranteed.

## Ventilation

**Table Showing the Quantity of Air, in Cubic Feet, Discharged per Minute Through a Flue of Which the Cross-Sectional Area is One Square Foot.**

(External temperature of the air, 32° Fahr.; allowance for friction, 50%)

Height of Flue in Feet	Excess of Temperature of Air in Flue Above That of External Air							
	10°	15°	20°	25°	30°	50°	100°	150°
1.....	34	42	48	54	59	76	108	133
5.....	76	94	109	121	134	167	242	298
10.....	108	133	153	171	188	242	342	419
15.....	133	162	188	210	230	297	419	514
20.....	153	188	217	242	265	342	484	593
25.....	171	210	242	271	297	383	541	663
30.....	188	230	265	297	325	419	593	726
35.....	203	248	286	320	351	453	640	784
40.....	217	265	306	342	375	484	684	838
45.....	230	282	325	363	398	514	724	889
50.....	242	297	342	383	419	541	765	937
60.....	264	325	373	420	461	594	835	1006
70.....	286	351	405	465	497	643	900	1115
80.....	306	375	453	485	530	688	965	1185
90.....	324	398	460	516	564	727	1027	1225
100.....	342	420	485	534	594	768	1080	1325
125.....	383	468	542	604	662	855	1210	1480
150.....	420	515	596	665	730	942	1330	1630

Above table for Gravity Ventilation taken from standard authorities—not guaranteed.

## B. T. U. Required for Heating Air

This table specifies the quantity of heat in British thermal units required to raise one cubic foot of air through any given temperature interval.

External Temperature	Temperature of Air in Room									
	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°
-40°.....	1.802	2.027	2.252	2.479	2.703	2.928	3.154	3.379	3.604	3.829
-30°.....	1.540	1.760	1.980	2.200	2.420	2.640	2.860	3.080	3.300	3.520
-20°.....	1.290	1.505	1.720	1.935	2.150	2.365	2.580	2.795	3.010	3.225
-10°.....	1.051	1.262	1.473	1.684	1.892	2.102	2.311	2.522	2.732	2.943
0°.....	0.822	1.028	1.234	1.439	1.645	1.851	2.056	2.262	2.467	2.673
10°.....	0.604	0.805	1.007	1.208	1.409	1.611	1.812	2.013	2.215	2.416
20°.....	0.393	0.590	0.787	0.984	1.181	1.378	1.575	1.771	1.968	2.165
30°.....	0.192	0.385	0.578	0.770	0.963	1.155	1.345	1.540	1.733	1.925
40°.....	0.000	0.188	0.376	0.564	0.752	0.940	1.128	1.316	1.504	1.692
50°.....	0.000	0.000	0.184	0.367	0.551	0.735	0.918	1.102	1.286	1.470
60°.....	0.000	0.000	0.000	0.179	0.359	0.538	0.718	0.897	1.077	1.256
70°.....	0.000	0.000	0.000	0.000	0.175	0.350	0.525	0.700	0.875	1.049

Above table from F. Schumann's Manual of Heating and Ventilation, pages 64 and 41.



# DATA FOR THE FITTER

## Properties of Air

Temperature Degrees Fahrenheit	B. T. U. Absorbed by 1 Cubic Foot Dry Air per Degree Fahr.	B. T. U. Absorbed by 1 Cubic Foot Saturated Air per Degree Fahr.	Cubic Feet Dry Air Warmed 1 Degree per B. T. U.	Cubic Feet Saturated Air Warmed 1 Degree per B. T. U.
0	0.02056	0.02054	48.5	48.7
12	0.02004	0.02006	50.1	50.0
22	0.01961	0.01963	51.1	51.0
32	0.01921	0.01924	52.0	51.8
42	0.01882	0.01884	53.2	52.8
52	0.01847	0.01848	54.0	53.8
60	0.01818	0.01822	55.0	54.6
62	0.01811	0.01812	55.2	54.7
70	0.01777	0.01794	56.3	55.5
72	0.01777	0.01790	56.5	55.8
82	0.01744	0.01770	57.2	56.5
92	0.01710	0.01751	58.5	57.1
100	0.01690	0.01735	59.1	57.8
102	0.01682	0.01731	59.5	57.8
112	0.01651	0.01711	60.6	58.5
122	0.01623	0.01691	61.7	59.1
132	0.01596	0.01670	62.5	59.9
142	0.01571	0.01652	63.7	60.6
152	0.01544	0.01634	65.0	61.5
162	0.01518	0.01616	66.2	62.4
172	0.01494	0.01598	67.1	63.5
182	0.01471	0.01580	68.0	64.2
192	0.01449	.....	68.9	.....
202	0.01426	.....	69.5	.....
212	0.01406	.....	71.4	.....

## Volume and Density of Air

### At Various Temperatures

Temp. Degrees Fahr.	Volume 1 lb. of Air at Atmos- pheric Pressure 14.7 lbs. Cubic Feet	Density or Weight of 1 Cu. Ft. of Air at 14.7 lbs. Pressure Lbs.	Temp. Degrees Fahr.	Volume of 1 lb. of Air at Atmos- pheric Pressure 14.7 lbs. Cubic Feet	Density or Weight of 1 Cu. Ft. of Air at 14.7 lbs. Pressure Lbs.
0	11.583	0.086331	210	16.860	0.059313
32	12.387	0.080728	212	16.910	0.059135
40	12.586	0.079439	220	17.111	0.058442
50	12.840	0.077884	240	17.612	0.056774
62	13.141	0.076097	260	18.116	0.055200
70	13.342	0.074950	280	18.621	0.053710
80	13.593	0.073565	300	19.121	0.052297
90	13.845	0.072230	320	19.624	0.050950
100	14.096	0.070942	340	20.126	0.049686
120	14.592	0.068500	360	20.630	0.048476
140	15.100	0.066221	380	21.131	0.047322
160	15.603	0.064088	400	21.634	0.046223
180	16.106	0.062090	425	22.262	0.044920
200	16.606	0.060210	450	22.890	0.043686

## Relative Humidity of the Air

Difference of Temp. Wet and Dry Bulb	Temperature of the Air			Difference of Temp. Wet and Dry Bulb	Temperature of the Air		
	32 Degrees Fahr.	70 Degrees Fahr.	90 Degrees Fahr.		32 Degrees Fahr.	70 Degrees Fahr.	90 Degrees Fahr.
0.5	95	98	98	9.0	12	60	68
1.0	90	95	96	10.0	3	55	65
2.0	79	90	92	12.0	..	48	59
3.0	69	86	88	14.0	..	40	53
4.0	59	81	85	16.0	..	33	47
5.0	50	77	81	18.0	..	26	41
6.0	40	72	78	20.0	..	19	36
7.0	31	68	75	22.0	..	13	32
8.0	21	64	71	24.0	..	7	26

## Moisture Absorbed by Air

The quantity of water which air is capable of absorbing to the point of maximum saturation, in grains per cubic foot for various temperatures.

Degrees Fahr.	Grains in a Cu. Ft.	Degrees Fahr.	Grains in a Cu. Ft.	Degrees Fahr.	Grains in a Cu. Ft.	Degrees Fahr.	Grains in a Cu. Ft.
-20	0.219	25	1.611	55	4.849	75	9.356
-10	0.356	30	1.958	57	5.191	77	9.961
-5	0.450	32	2.113	60	5.744	80	10.933
0	0.564	35	2.366	62	6.142	85	12.736
5	0.705	40	2.849	65	6.782	90	14.791
10	0.873	45	3.414	67	7.241	95	17.124
15	1.075	50	4.076	70	7.980	100	19.766
20	1.321	52	4.372	72	8.508	105	22.751

## Volume of Air Necessary for Standard of Purity

Cubic Feet of Space in Room per Individual	Proportion of Carbonic Acid in 10,000 Parts of the Air not to be exceeded at end of hour						
	6	7	8	9	10	15	20
	Cubic Feet of Air, of Composition Four Parts of Carbonic Acid in 10,000, to be supplied the first hour						
100	2900	1900	1400	1100	900	445	275
200	2800	1800	1300	1000	800	345	175
300	2700	1700	1200	900	700	245	75
400	2600	1600	1100	800	600	145	None
500	2500	1500	1000	700	500	45	...
600	2400	1400	900	600	400	None	...
700	2300	1300	800	500	300	...	...
800	2200	1200	700	400	200	...	...
900	2100	1100	600	300	100	...	...
1000	2000	1000	500	200	None	...	...
1500	1500	500	None	None	...	...	...
2000	1000	None	....	....	...	...	...
2500	500	....	....	....	...	...	...

Note: Above information quoted from standard authorities—not guaranteed.

# DATA FOR THE FITTER

## Air Heating Table

Cubic feet of air one B. T. U. will raise one degree Fahr. at different temperatures:

Specific heat of air .2375. At zero one cubic foot of air weighs .0864 lb. and  $\frac{1 \text{ lb.}}{.0864} = 11.574$  cubic feet  $\frac{11.574}{.2375} = 48.77$  cubic ft. raised one degree by 1 B. T. U.

From this formula the following table is constructed, small fractional decimals being omitted.

Temp. Air F. Deg.	Weight of 1 Cu. Ft.	Cu. Ft. in 1 lb.	Cu. Ft. 1 H. U. Will Raise 1 Deg.F.	Temp. Air F. Deg.	Weight of 1 Cu. Ft.	Cu. Ft. in 1 lb.	Cu. Ft. 1 H. U. Will Raise 1 Deg.F.
0	.0864	11.58	48.77	112	.0694	14.40	60.60
12	.0842	11.87	50.00	122	.0682	14.65	61.60
22	.0824	12.14	51.00	132	.0671	14.90	62.80
32	.0807	12.40	52.20	142	.0660	15.15	63.80
42	.0791	12.64	53.10	152	.0649	15.40	64.90
52	.0776	12.88	54.10	162	.0638	15.65	66.00
62	.0761	13.13	55.20	172	.0628	15.90	67.00
70	.0750	13.34	56.30	182	.0618	16.17	68.00
72	.0747	13.39	56.40	192	.0609	16.42	69.10
82	.0733	13.64	57.40	202	.0600	16.67	70.10
92	.0720	13.90	58.60	212	.0591	16.92	71.30
102	.0707	14.14	59.20	.....	.....	.....	.....

## Indirect Heating

Table for Quick Calculating of Pipes and Areas for Indirect Heating for Moderate Sized Steam or Water-Heating Plants

Dimensions of Pipe	Area in Square Inches	Size of Register Required
8 inches.....	50	8 x 12
9 inches.....	63	9 x 14
10 inches.....	78	10 x 16
12 inches.....	113	14 x 16
14 inches.....	154	16 x 20
16 inches.....	201	18 x 24
18 inches.....	254	20 x 26
20 inches.....	314	24 x 27
22 inches.....	380	24 x 32
24 inches.....	452	30 x 30

Note: Above information is quoted from standard authorities—not guaranteed.

## Registers

Table for Calculating Free Area of Air Passage in  
Indirect and Hot-Blast Heating

Register Opening	Free Area in Square Feet	Register Opening	Free Area in Square Feet
8 x 8	0.30	18 x 24	2.00
8 x 10	0.37	18 x 27	2.25
8 x 12	0.44	18 x 30	2.50
9 x 12	0.50	18 x 36	3.00
10 x 10	0.46	20 x 20	1.85
10 x 12	0.56	20 x 22	2.04
10 x 14	0.65	20 x 24	2.22
10 x 16	0.74	20 x 26	2.41
10 x 18	0.83	20 x 28	2.59
10 x 20	0.93	20 x 30	2.77
10 x 22	1.02	20 x 32	2.96
10 x 24	1.11	20 x 36	3.33
12 x 12	0.67	24 x 24	2.67
12 x 14	0.78	24 x 27	3.00
12 x 15	0.83	24 x 30	3.33
12 x 16	0.89	24 x 32	3.55
12 x 18	1.00	24 x 36	4.00
12 x 24	1.33	24 x 45	5.00
14 x 14	0.91	27 x 27	3.37
14 x 16	1.04	27 x 38	4.75
14 x 18	1.17	28 x 28	3.63
14 x 20	1.30	28 x 30	3.88
14 x 22	1.43	28 x 32	4.15
16 x 16	1.19	28 x 36	4.66
16 x 18	1.33	30 x 30	4.17
16 x 20	1.48	30 x 36	5.00
16 x 22	1.63	30 x 42	5.83
16 x 24	1.78	30 x 48	6.67
16 x 28	2.07	36 x 36	6.00
16 x 30	2.22	36 x 40	6.67
16 x 32	2.37	36 x 42	7.00
16 x 36	2.67	36 x 48	8.00
18 x 18	1.50	38 x 38	6.67
18 x 20	1.67	38 x 40	7.03
18 x 21	1.75	38 x 42	7.38



## Pressures and Boiling Points of Water for Given Static Heads

Height of Column, Feet	Pressure per Square Inch, Pounds	Boiling Point at Boiler, which is at the Bottom of the Column, Degrees Fahrenheit
2	0.866	214.9
3	1.299	216.3
4	1.732	217.6
5	2.165	219.0
6	2.598	220.3
7	3.031	221.6
8	3.464	222.8
9	3.897	224.1
10	4.330	225.3
15	6.500	231.0
20	8.660	236.2
25	10.830	241.2
30	12.990	245.7
35	15.160	249.9
40	17.320	253.8
45	19.490	257.7
50	21.650	261.3

An artificial pressure may be carried on a water-heating apparatus by closing the outlet of the tank by a safety-valve. This is done sometimes to increase the temperature of the water, and at other times to cause a more rapid circulation in remote parts of the apparatus.

The reason that the flow of water through the pipes is accelerated by increasing the pressure is because that with the higher temperature, due to the pressure, the rising line of pipe, or flow-pipe from the boiler, is emulsed with steam, making it much lighter than the return column, and thus causing a more rapid circulation of the water through the system.

# DATA FOR THE FITTER

## Velocity of Flow of Water

In Feet per Minute, Through Pipes of Various Sizes, for Varying Quantities of Flow

Gals. Per Min.	$\frac{3}{4}$ Inch	1 Inch	$1\frac{1}{4}$ Inch	$1\frac{1}{2}$ Inch	2 Inch	$2\frac{1}{2}$ Inch	3 Inch	4 Inch
5	218	122 $\frac{1}{2}$	78 $\frac{1}{2}$	54 $\frac{1}{2}$	30 $\frac{1}{2}$	19 $\frac{1}{2}$	13 $\frac{1}{2}$	7 $\frac{3}{4}$
10	436	245	157	109	61	38	27	15 $\frac{1}{4}$
15	653	367 $\frac{1}{2}$	235 $\frac{1}{2}$	163 $\frac{1}{2}$	91 $\frac{1}{2}$	58 $\frac{1}{2}$	40 $\frac{1}{2}$	23
20	872	490	314	218	122	78	54	30 $\frac{3}{4}$
25	1090	612 $\frac{1}{2}$	392 $\frac{1}{2}$	272 $\frac{1}{2}$	152 $\frac{1}{2}$	97 $\frac{1}{2}$	67 $\frac{1}{2}$	38 $\frac{1}{2}$
30	....	735	451	327	183	117	81	46
35	....	857 $\frac{1}{2}$	549 $\frac{1}{2}$	381 $\frac{1}{2}$	213 $\frac{1}{2}$	136 $\frac{1}{2}$	94 $\frac{1}{2}$	53 $\frac{3}{4}$
40	....	980	628	436	244	156	108	61 $\frac{1}{4}$
45	....	1102 $\frac{1}{2}$	706 $\frac{1}{2}$	490 $\frac{1}{2}$	274 $\frac{1}{2}$	175 $\frac{1}{2}$	121 $\frac{1}{2}$	69
50	....	....	785	545	305	195	135	76 $\frac{3}{4}$
75	....	....	1177 $\frac{1}{2}$	817 $\frac{1}{2}$	457 $\frac{1}{2}$	292 $\frac{1}{2}$	202 $\frac{1}{2}$	115
100	....	....	....	1090	610	380	270	153 $\frac{1}{4}$
125	....	....	....	....	762 $\frac{1}{2}$	487 $\frac{1}{2}$	337 $\frac{1}{2}$	191 $\frac{3}{4}$
150	....	....	....	....	915	585	405	230
175	....	....	....	....	1067 $\frac{1}{2}$	682 $\frac{1}{2}$	472 $\frac{1}{2}$	268 $\frac{1}{4}$
200	....	....	....	....	1220	780	540	306 $\frac{3}{4}$

## Heat Units in One Pound Water

Tem- pera- ture Deg.	Number of Thermal Units	In- crease	Tem- pera- ture Deg.	Number of Thermal Units	In- crease	Tem- pera- ture Deg.	Number of Thermal Units	In- crease
35	35.000	.....	155	155.339	5.034	275	276.985	5.107
40	40.001	5.001	160	160.374	5.035	280	282.095	5.110
45	45.002	5.001	165	165.413	5.039	285	287.210	5.115
50	50.003	5.001	170	170.453	5.040	290	292.329	5.119
55	55.006	5.003	175	175.497	5.044	295	297.452	5.123
60	60.009	5.003	180	180.542	5.045	300	302.580	5.128
65	65.014	5.005	185	185.591	5.049	305	307.712	5.132
70	70.020	5.006	190	190.643	5.052	310	312.848	5.136
75	75.027	5.007	195	195.697	5.054	315	317.988	5.140
80	80.036	5.009	200	200.753	5.056	320	323.134	5.146
85	85.045	5.009	205	205.813	5.060	325	328.284	5.150
90	90.055	5.010	210	210.874	5.061	330	333.438	5.154
95	95.067	5.012	215	215.939	5.065	335	338.596	5.158
100	100.080	5.013	220	221.007	5.068	340	343.759	5.163
105	105.095	5.015	225	226.078	5.071	345	348.927	5.168
110	110.110	5.015	230	231.153	5.075	350	354.101	5.174
115	115.129	5.019	235	236.232	5.079	355	359.280	5.179
120	120.149	5.020	240	241.313	5.081	360	364.464	5.184
125	125.169	5.020	245	246.398	5.085	365	369.653	5.189
130	130.192	5.023	250	251.487	5.089	370	374.866	5.193
135	135.217	5.025	255	256.579	5.092	375	380.044	5.198
140	140.245	5.028	260	261.674	5.095	380	385.247	5.203
145	145.175	5.030	265	266.774	5.100	385	390.456	5.209
150	150.305	5.030	270	271.878	5.104	390	395.672	5.216

Note: Above information quoted from standard authorities—not guaranteed.

# DATA FOR THE FITTER

## Boiling Point of Water at Various Altitudes

Boiling Point Degrees Fahr.	Altitude Above Sea Level Ft.	Atmos- pheric Pressure Pounds per Sq. In.	Baro- meter Reduced to 30 Degrees Inches	Boiling Point Degrees Fahr.	Altitude Above Sea Level Ft.	Atmos- pheric Pressure Pounds per Sq. In.	Baro- meter Reduced to 32 Degrees Inches
184	15221	8.20	16.70	199	6843	11.29	22.90
185	14649	8.38	17.96	200	6304	11.52	23.47
186	14075	8.57	17.45	201	5764	11.76	23.95
187	13498	8.76	17.83	202	5225	12.01	24.45
188	12934	8.95	18.22	203	4697	12.26	24.96
189	12367	9.14	18.61	204	4169	12.51	25.48
190	11799	9.34	19.02	205	3642	12.77	26.00
191	11243	9.54	19.43	206	3115	13.03	26.53
192	10685	9.74	19.85	207	2589	13.30	27.08
193	10127	9.95	20.27	208	2063	13.57	27.63
194	9579	10.17	20.71	209	1539	13.85	28.19
195	9031	10.39	21.15	210	1025	14.13	28.76
196	8481	10.61	21.60	211	512	14.41	29.33
197	7932	10.83	22.05	212	Sea Level	14.70	29.92
198	7381	11.06	22.52	...	.....	.....	.....

## Number of Gallons in Tanks

Length or Depth Feet	Diameter, Inches									
	18	24	30	36	42	48	54	60	66	72
...	18	24	30	36	42	48	54	60	66	72
2	26	47	73	105	144	188	238	294	356	424
2½	33	59	90	131	180	235	298	367	445	530
3	40	71	109	157	216	282	357	440	534	636
3½	47	83	127	183	252	329	416	513	623	742
4	54	95	145	209	288	376	475	586	712	848
4½	61	107	163	235	324	423	534	659	801	954
5	68	119	180	261	360	470	593	732	890	1060
5½	75	131	200	287	396	517	652	805	979	1166
6	82	143	217	313	432	564	711	878	1068	1272
6½	89	155	235	339	468	611	770	951	1157	1378
7	96	167	253	365	504	658	829	1024	1246	1484
7½	103	179	271	391	540	705	888	1097	1335	1590
8	110	191	289	417	576	752	947	1170	1424	1696
8½	...	203	307	443	612	799	1006	1243	1513	1802
10	...	239	361	521	720	940	1183	1462	1780	2120
12	...	287	433	625	864	1128	1419	1754	2136	2544
14	...	...	...	...	1008	1316	1655	2046	2492	2968
16	...	...	...	...	1152	1504	1891	2338	2848	3392
18	...	...	...	...	...	...	2127	2630	3204	3816
20	...	...	...	...	...	...	2363	2922	3560	4240

Note: Above information quoted from standard authorities — not guaranteed.

## Hot Water Supply Boilers

### Rule for Determining the Amount of Radiation Each Size Will Supply

The amount of radiation a Hot Water Supply Boiler will supply at manufacturer's established basis of rating can be estimated by dividing the capacity in gallons by 1.30, since it is generally accepted that a foot of radiation is equal to a Hot Water Supply Boiler capacity of 30 per cent more expressed in gallons, or 1.30 gallons.

## Swimming Pools

### Rule for Determining the Boiler Capacity Necessary to Heat a Swimming Pool

Multiply the length by the width of the pool expressed in feet and this result multiplied by the average depth of the water will give the capacity of the pool expressed in cubic feet.

From the table on the opposite page find the number of pounds per cubic foot at the initial temperature of the water. Multiplying this quantity by the number of cubic feet will give the number of pounds of water to be heated.

The number of pounds of water multiplied by the difference between the initial temperature and the temperature to which the water is to be raised equals the B. T. U. to be supplied. Dividing this result by the number of hours allowed for heating gives the B. T. U. to be supplied per hour.

Divide the B. T. U. required per hour by 150 to determine the rating of the water boiler or by 240 to determine the rating of the steam boiler.

If the quantity of water is given in gallons, multiply by  $8\frac{1}{3}$  to reduce to pounds. Approximately  $8\frac{1}{3}$  pounds is figured per gallon of water.



## Heat Units and Weight of Water

Between 32 and 212 degrees Fahrenheit and weight of water per cubic foot. Water does not exist below 32 degrees and ice follows another law.

Tem- pera- ture Degrees F.	Heat Units	Weight in Pounds per Cubic Foot	Tem- pera- ture Degrees F.	Heat Units	Weight in Pounds per Cubic Foot	Tem- pera- ture Degrees F.	Heat Units	Weight in Pounds per Cubic Foot
32	0.	62.42	123	91.16	61.68	168	136.44	60.81
35	3.	62.42	124	92.17	61.67	169	137.45	60.79
40	8.	62.42	125	93.17	61.65	170	138.45	60.77
45	13.	62.42	126	94.17	61.63	171	139.46	60.75
50	18.	62.41	127	95.18	61.61	172	140.47	60.73
52	20.	62.40	128	96.18	61.60	173	141.48	60.70
54	22.01	62.40	129	97.19	61.58	174	142.49	60.68
56	24.01	62.39	130	98.19	61.56	175	143.50	60.66
58	26.01	62.38	131	99.20	61.54	176	144.51	60.64
60	28.01	62.37	132	100.20	61.52	177	145.52	60.62
62	30.01	62.36	133	101.21	61.51	178	146.52	60.59
64	32.01	62.35	134	102.21	61.49	179	147.53	60.57
66	34.02	62.34	135	103.22	61.47	180	148.54	60.55
68	36.02	62.33	136	104.22	61.45	181	149.55	60.53
70	38.02	62.31	137	105.23	61.43	182	150.56	60.50
72	40.02	62.30	138	106.23	61.41	183	151.57	60.48
74	42.03	62.28	139	107.24	61.39	184	152.58	60.46
76	44.03	62.27	140	108.25	61.37	185	153.59	60.44
78	46.03	62.25	141	109.25	61.36	186	154.60	60.41
80	48.04	62.23	142	110.26	61.34	187	155.61	60.39
82	50.04	62.21	143	111.26	61.32	188	156.62	60.37
84	52.04	62.19	144	112.27	61.30	189	157.63	60.34
86	54.05	62.17	145	113.28	61.28	190	158.64	60.32
88	56.05	62.15	146	114.28	61.26	191	159.65	60.29
90	58.06	62.13	147	115.29	61.24	192	160.67	60.27
92	60.06	62.11	148	116.29	61.22	193	161.68	60.25
94	62.06	62.09	149	117.30	61.20	194	162.69	60.22
96	64.07	62.07	150	118.31	61.18	195	163.70	60.20
98	66.07	62.05	151	119.31	61.16	196	164.71	60.17
100	68.08	62.02	152	120.32	61.14	197	165.72	60.15
102	70.09	62.00	153	121.33	61.12	198	166.73	60.12
104	72.09	61.97	154	122.33	61.10	199	167.74	60.10
106	74.10	61.95	155	123.34	61.08	200	168.75	60.07
108	76.10	61.92	156	124.35	61.06	201	169.77	60.05
110	78.11	61.89	157	125.35	61.04	202	170.78	60.02
112	80.12	61.86	158	126.36	61.02	203	171.79	60.00
114	82.13	61.83	159	127.37	61.00	204	172.80	59.97
115	83.13	61.82	160	128.37	60.98	205	173.81	59.95
116	84.13	61.80	161	129.38	60.96	206	174.83	59.92
117	85.14	61.78	162	130.39	60.94	207	175.84	59.89
118	86.14	61.77	163	131.40	60.92	208	176.85	59.87
119	87.15	61.75	164	132.41	60.90	209	177.86	59.84
120	88.15	61.74	165	133.41	60.87	210	178.87	59.82
121	89.15	61.72	166	134.42	60.85	211	179.89	59.79
122	90.16	61.70	167	135.43	60.83	212	180.90	59.76

# DATA FOR THE FITTER

## Properties of Saturated Steam

Boiling Temp.	Absolute Press. the Sq. In.	Inches Vacuum	Steam Gauge Press. Lbs.	Latent Heat	Heat Liquid	Vol. 1 lb. Steam Cu. Ft.
157	4.408	20.94	.....	1003.4	124.86	82.6
161	4.851	20.04	.....	1001.6	127.86	77.2
165	5.333	19.06	.....	998.7	132.86	69.1
169	5.855	18.00	.....	996.4	136.86	63.3
172	6.273	17.15	.....	994.6	139.87	59.4
176	6.867	15.94	.....	992.3	143.87	54.5
179	7.344	14.97	.....	990.5	146.88	51.2
182	7.85	13.94	.....	988.7	149.89	48.12
185	8.38	12.85	.....	986.9	152.89	45.25
187	8.76	12.09	.....	985.7	154.90	43.45
190	9.34	10.90	.....	983.9	157.91	40.91
192	9.74	10.09	.....	982.7	159.91	39.31
194	10.17	9.21	.....	981.5	161.92	37.78
197	10.83	7.87	.....	979.7	164.93	35.62
199	11.29	6.93	.....	978.8	166.94	34.26
201	11.76	5.97	.....	977.2	168.94	32.96
203	12.26	4.96	.....	976.0	170.95	31.72
205	12.77	3.92	.....	974.7	172.96	30.53
207	13.30	2.84	.....	973.5	174.97	29.39
209	13.85	1.73	.....	972.2	176.98	28.32
210	14.13	1.16	.....	971.6	177.99	27.80
212	14.70	.....	.....	970.4	180.00	26.79
215	15.60	.....	0.90	968.4	183.00	25.35
217	16.22	.....	1.72	967.2	185.00	24.44
219	16.86	.....	2.16	965.9	187.10	23.57
222	17.87	.....	3.17	963.9	190.10	22.34
225	18.91	.....	4.21	962.0	193.10	21.17
227	19.64	.....	4.94	960.7	195.20	20.44
230	20.77	.....	6.07	958.7	198.20	19.39
232	21.56	.....	6.86	957.4	200.20	18.72
235	22.79	.....	8.09	955.4	203.2	17.78
237	23.64	.....	8.94	954.1	205.3	17.17
240	24.97	.....	10.27	952.1	208.3	16.32
242	25.88	.....	11.18	950.7	210.3	15.78
244	26.83	.....	12.13	949.4	212.4	15.26
246	27.80	.....	13.10	948.0	214.4	14.76
248	28.80	.....	14.10	946.7	216.4	14.28
250	29.82	.....	15.12	945.3	218.5	13.82
252	30.88	.....	16.18	943.9	220.5	13.37
255	32.53	.....	17.83	941.9	223.5	12.74
257	33.66	.....	18.96	940.5	225.6	12.34
259	34.83	.....	20.13	939.1	227.6	11.95

Note: Above information quoted from standard authorities—not guaranteed.

## Temperature of Steam at Different Pressures

Pressure in Pounds		Temperature in Degrees
By Steam Gauge	Above Atmosphere	
0	15	212
5	20	228
10	25	240
15	30	250
20	35	259
25	40	267
30	45	274
35	50	281
40	55	287
45	60	292
50	65	298
55	70	302
60	75	307
65	80	312
70	85	316
75	90	320
80	95	324
85	100	327
90	105	331
95	110	334
100	115	338
110	125	344
120	135	350
130	145	355
140	155	361
150	165	366

## Boiling Points of Various Fluids

Water in Vacuum.....	98°
Water in Atmospheric Pressure.....	212°
Alcohol.....	173°
Sulphuric Acid.....	240°
Refined Petroleum.....	316°
Turpentine.....	315°
Sulphur.....	570°
Linseed Oil.....	597°

NOTE: Above information quoted from standard authorities—  
not guaranteed.

# Tables of Diameters, Circumferences, and Areas of Circles

And the Contents in Gallons at One Foot in Depth  
Area in Inches

Dia.	Circ. In.	Area, In.	Gallons	Dia.	Circ. In.	Area, In.	Gallons
$\frac{1}{8}$	.3927	.0123	.....	$6\frac{1}{4}$	19.635	30.679	1.59531
$\frac{1}{4}$	.7854	.0491	.....	$\frac{3}{8}$	20.027	31.919	1.65979
$\frac{3}{8}$	1.1781	.1104	.....	$\frac{1}{2}$	20.420	33.183	1.72552
$\frac{1}{2}$	1.5708	.1963	.....	$\frac{5}{8}$	20.813	34.471	1.79249
$\frac{3}{4}$	2.3562	.4418	.....	$\frac{3}{4}$	21.205	35.784	1.86077
1 in.	3.1416	.7854	.04084	$\frac{7}{8}$	21.598	37.122	1.93034
$\frac{1}{8}$	3.5343	.9940	.05169	7 in.	21.991	38.484	2.00117
$\frac{1}{4}$	3.9270	1.2271	.06380	$\frac{1}{8}$	22.383	39.871	2.07329
$\frac{3}{8}$	4.3197	1.4848	.07717	$\frac{1}{4}$	22.776	41.282	2.14666
$\frac{1}{2}$	4.7124	1.7671	.09188	$\frac{3}{8}$	23.169	42.718	2.22134
$\frac{5}{8}$	5.1051	2.0739	.10784	$\frac{1}{2}$	23.562	44.178	2.29726
$\frac{3}{4}$	5.4978	2.4052	.12506	$\frac{5}{8}$	23.954	45.663	2.37448
$\frac{7}{8}$	5.8905	2.7611	.14357	$\frac{3}{4}$	24.347	47.173	2.45299
2 in.	6.2832	3.1416	.16333	$\frac{7}{8}$	24.740	48.707	2.53276
$\frac{1}{8}$	6.6759	3.5465	.18439	8 in.	25.132	50.265	2.61378
$\frac{1}{4}$	7.0686	3.9760	.20675	$\frac{1}{8}$	25.515	51.848	2.69609
$\frac{3}{8}$	7.4613	4.4302	.23036	$\frac{1}{4}$	25.918	53.456	2.77971
$\frac{1}{2}$	7.8540	4.9087	.25522	$\frac{3}{8}$	26.310	55.088	2.86458
$\frac{5}{8}$	8.2467	5.4119	.28142	$\frac{1}{2}$	26.703	56.745	2.95074
$\frac{3}{4}$	8.6304	5.9395	.30883	$\frac{5}{8}$	27.096	58.426	3.03815
$\frac{7}{8}$	9.0321	6.4918	.33753	$\frac{3}{4}$	27.489	60.132	3.12686
3 in.	9.4248	7.0686	.36754	$\frac{7}{8}$	27.881	61.862	3.21682
$\frac{1}{8}$	9.8175	7.6699	.39879	9 in.	28.274	63.617	3.30408
$\frac{1}{4}$	10.210	8.2957	.43134	$\frac{1}{8}$	28.667	65.396	3.40059
$\frac{3}{8}$	10.602	8.9462	.46519	$\frac{1}{4}$	29.059	67.200	3.49440
$\frac{1}{2}$	10.995	9.6211	.50029	$\frac{3}{8}$	29.452	69.029	3.58951
$\frac{5}{8}$	11.388	10.320	.53664	$\frac{1}{2}$	29.845	70.882	3.68586
$\frac{3}{4}$	11.781	11.044	.57429	$\frac{5}{8}$	30.237	72.759	3.78347
$\frac{7}{8}$	12.173	11.793	.61324	$\frac{3}{4}$	30.630	74.662	3.88242
4 in.	12.566	12.566	.65343	$\frac{7}{8}$	31.023	76.588	3.98253
$\frac{1}{8}$	12.959	13.364	.69493	10 in.	31.416	78.540	4.08408
$\frac{1}{4}$	13.351	14.186	.73767	$\frac{1}{8}$	31.808	80.515	4.18678
$\frac{3}{8}$	13.744	15.033	.78172	$\frac{1}{4}$	32.201	82.516	4.29083
$\frac{1}{2}$	14.137	15.904	.82701	$\frac{3}{8}$	32.594	84.540	4.39608
$\frac{5}{8}$	14.529	16.800	.87360	$\frac{1}{2}$	32.986	86.590	4.50268
$\frac{3}{4}$	14.922	17.720	.92144	$\frac{5}{8}$	33.379	88.664	4.61053
$\frac{7}{8}$	15.315	18.665	.97058	$\frac{3}{4}$	33.772	90.762	4.71962
5 in.	15.708	19.635	1.02102	$\frac{7}{8}$	34.164	92.885	4.82846
$\frac{1}{8}$	16.100	20.629	1.07271	11 in.	34.557	95.033	4.94172
$\frac{1}{4}$	16.493	21.647	1.12564	$\frac{1}{8}$	34.950	97.205	5.05466
$\frac{3}{8}$	16.886	22.690	1.17988	$\frac{1}{4}$	35.343	99.402	5.16890
$\frac{1}{2}$	17.278	23.758	1.23542	$\frac{3}{8}$	35.735	101.623	5.28439
$\frac{5}{8}$	17.671	24.850	1.29220	$\frac{1}{2}$	36.128	103.869	5.40119
$\frac{3}{4}$	18.064	25.967	1.35028	$\frac{5}{8}$	36.521	106.139	5.51923
$\frac{7}{8}$	18.457	27.108	1.40962	$\frac{3}{4}$	36.913	108.434	5.63857
6 in.	18.849	28.274	1.47025	$\frac{7}{8}$	37.306	110.753	5.75916
$\frac{1}{8}$	19.242	29.464	1.53213				

Note: Above information quoted from standard authorities — not guaranteed.



# Table of Diameters, Circumferences, and Areas of Circles

And the Contents in Gallons at One Foot in Depth  
Area in Feet

Dia.		Circ.		Area in Ft.	Gallons	Dia.		Circ.		Area in Ft.	Gallons
Ft.	In.	Ft.	In.		1 ft. depth	Ft.	In.	Ft.	In.		1 ft. depth
1		3	1 $\frac{1}{8}$	.7854	5.8735	4	8	14	7 $\frac{7}{8}$	17.1041	127.9112
1	1	3	4 $\frac{3}{8}$	.9217	6.8928	4	9	14	11	17.7205	132.5209
1	2	3	8	1.0690	7.9944	4	10	15	2 $\frac{1}{8}$	18.3476	137.2105
1	3	3	11	1.2271	9.1766	4	11	15	5 $\frac{1}{4}$	18.9858	142.0582
1	4	4	2 $\frac{1}{8}$	1.3962	10.4413	5		15	8 $\frac{1}{2}$	19.6350	146.8384
1	5	4	5 $\frac{3}{8}$	1.5761	11.7866	5	1	15	11 $\frac{3}{8}$	20.2947	151.7718
1	6	4	8 $\frac{1}{2}$	1.7671	13.2150	5	2	16	2 $\frac{3}{4}$	20.9656	156.7891
1	7	4	11 $\frac{3}{8}$	1.9689	14.7241	5	3	16	5 $\frac{3}{4}$	21.6475	161.8886
1	8	5	2 $\frac{3}{4}$	2.1816	16.3148	5	4	16	9	22.3400	167.0674
1	9	5	5 $\frac{7}{8}$	2.4052	17.9870	5	5	17	0 $\frac{1}{8}$	23.0437	172.3300
1	10	5	9	2.6398	19.7414	5	6	17	3 $\frac{1}{4}$	23.7583	177.6740
1	11	6	2 $\frac{1}{4}$	2.8852	21.4830	5	7	17	6 $\frac{3}{8}$	24.4835	183.0973
2		6	3 $\frac{3}{8}$	3.1416	23.4940	5	8	17	9 $\frac{1}{8}$	25.2199	188.6045
2	1	6	6 $\frac{1}{2}$	3.4087	25.4916	5	9	18	0 $\frac{3}{4}$	25.9672	194.1930
2	2	6	9 $\frac{3}{8}$	3.6869	27.5720	5	10	18	3 $\frac{7}{8}$	26.7251	199.8610
2	3	7	0 $\frac{3}{4}$	3.9760	29.7340	5	11	18	7 $\frac{1}{8}$	27.4943	205.6133
2	4	7	3 $\frac{7}{8}$	4.2760	32.6976	6		18	10 $\frac{1}{8}$	28.2744	211.4472
2	5	7	7	4.5869	34.3027	6	3	19	7 $\frac{1}{2}$	30.6796	229.4342
2	6	7	10 $\frac{1}{4}$	4.9087	36.7092	6	6	20	4 $\frac{1}{8}$	33.1831	248.1564
2	7	8	1 $\frac{3}{8}$	5.2413	39.1964	6	9	21	2 $\frac{3}{8}$	35.7847	267.6122
2	8	8	4 $\frac{1}{2}$	5.5850	41.7668	7		21	11 $\frac{7}{8}$	38.4846	287.8230
2	9	8	7 $\frac{3}{8}$	5.9395	44.4179	7	3	22	9 $\frac{1}{4}$	41.2825	308.7270
2	10	8	10 $\frac{3}{4}$	6.3049	47.1505	7	6	23	6 $\frac{3}{4}$	44.1787	330.3859
2	11	9	1 $\frac{1}{8}$	6.6813	49.9654	7	9	24	4 $\frac{1}{8}$	47.1730	352.7665
3		9	5	7.0686	52.8618	8		25	1 $\frac{1}{2}$	50.2656	375.9062
3	1	9	8 $\frac{1}{4}$	7.4666	55.8382	8	3	25	11	53.4562	399.7668
3	2	9	11 $\frac{3}{8}$	7.8757	58.8976	8	6	26	8 $\frac{3}{8}$	56.7451	424.3625
3	3	10	2 $\frac{1}{2}$	8.2957	62.0386	8	9	27	5 $\frac{3}{4}$	60.1321	449.2118
3	4	10	5 $\frac{5}{8}$	8.7265	65.2602	9		28	3 $\frac{1}{4}$	63.6174	475.7563
3	5	10	8 $\frac{3}{4}$	9.1683	68.5193	9	3	29	0 $\frac{5}{8}$	67.2007	502.5536
3	6	10	11 $\frac{7}{8}$	9.6211	73.1504	9	6	29	10 $\frac{1}{8}$	70.8823	530.0861
3	7	11	3	10.0846	75.4166	9	9	30	7 $\frac{1}{2}$	74.6620	558.3522
3	8	11	6 $\frac{1}{8}$	10.5591	78.9652	10		31	5	78.5400	587.3534
3	9	11	9 $\frac{3}{8}$	11.0446	82.5959	10	3	32	2 $\frac{3}{8}$	82.5160	617.0876
3	10	12	0 $\frac{1}{2}$	11.5409	86.3074	10	6	32	11 $\frac{3}{4}$	86.5903	647.5568
3	11	12	3 $\frac{5}{8}$	12.0481	90.1004	10	9	33	9 $\frac{1}{4}$	90.7627	678.2797
4		12	6 $\frac{3}{4}$	12.5664	93.9754	11		34	6 $\frac{3}{8}$	95.0334	710.6977
4	1	12	9 $\frac{7}{8}$	13.0952	97.9310	11	3	35	4 $\frac{7}{8}$	99.4021	743.3686
4	2	13	1	13.6353	101.9701	11	6	36	1 $\frac{1}{2}$	103.8691	776.7746
4	3	13	4 $\frac{1}{8}$	14.1862	103.0300	11	9	36	10 $\frac{7}{8}$	108.4342	810.9143
4	4	13	7 $\frac{1}{4}$	14.7479	110.2907	12		37	8 $\frac{3}{8}$	113.0976	848.1890
4	5	13	10 $\frac{1}{2}$	15.3206	114.5735	12	3	38	5 $\frac{3}{4}$	117.8590	881.3966
4	6	14	1 $\frac{3}{8}$	15.9043	118.9386	12	6	39	3 $\frac{1}{4}$	122.7187	917.7395
4	7	14	4 $\frac{5}{8}$	16.4986	123.3830	12	9	40	0 $\frac{5}{8}$	127.6765	954.8159

Note: Above information quoted from standard authorities—not guaranteed.

## **Cleaning Steam Boilers**

The Steam Boiler should be cleaned within one week after it is installed and in operation. This should be done to remove any accumulation of oil, grease, etc., which has a tendency to cause the boiler to foam, producing a very unsteady water line. It is thus necessary to blow off the boiler under pressure. If one blowing-off does not result in a steady water line and clear gauge-glass, the operation must be repeated a second and if necessary a third or fourth time.

Close all radiator valves, or, if the mains are equipped with valves, close both flow and return valves tightly.

Fill the boiler to the top of the gauge with water. Build a hot fire in the boiler and get up a pressure of 10 to 15 pounds.

Open the blow-off cock and be careful that sufficient fire is carried to maintain a pressure until the boiler is empty.

After doing this, draw the remaining fire and allow the boiler to cool down thoroughly. This will require one-half to one hour's time, after which close the blow-off cock and slowly fill boiler to water line.

Open all radiator valves or valves on flow and return mains and rebuild fire, and the heating plant is ready for operation.

## **How to Clean a Water-Gauge Glass on a Steam Boiler without Removing It.**

1. Draw a cupful of hot water from the boiler, into which pour at least a tablespoon of raw muriatic or other acid.

2. Close both water-gauge valves.

3. Open top water-gauge valve and also pet cock at bottom, and blow water out of glass. Then immediately close the top valve and submerge the end of the pet cock in cup of hot-water solution. A vacuum is at once created in the gauge glass which causes the solution in the cup to rush in.

4. Keep the pet cock immersed and operate the top valve, slightly opening and closing, alternately expelling and drawing in the solution until all grease, oil, or other matter adhering to the inside of the glass is cut out. Then close pet cock and open both water-gauge valves.

It is necessary to have one pound pressure of steam or more on the boiler before commencing this operation, which need not occupy more than ten minutes. The result is a clean glass without the risk of breakage and probable renewal of gaskets, which is frequently the case when removing the glass for cleaning.

## Weights and Measures

### Troy Weight

24 grains.....	1 pwt.	
20 pwt.....	1 ounce	12 ounces.....1 pound
Used for weighing gold, silver and jewels.		

### Apothecaries Weight

20 grains.....	1 scruple	8 drams.....1 ounce
3 scruples.....	1 dram	12 ounces.....1 pound
Ounce and pound are the same as in Troy Weight.		

### Avoirdupois Weight

27 $\frac{11}{32}$ grains.....	1 dram	4 quarters.....1 cwt.
16 drams.....	1 ounce	2,000 lbs.....1 short ton
16 ounces.....	1 pound	2,240 lbs.....1 long ton
25 pounds.....	1 quarter	

### Dry Measure

2 pints.....	1 quart	4 pecks.....1 bushel
8 quarts.....	1 peck	36 bushels.....1 chaldron

### Liquid Measure

4 gills.....	1 pint	31 $\frac{1}{2}$ gallons.....1 barrel
2 pints.....	1 quart	2 barrels.....1 hogshead
4 quarts.....	1 gallon	

### Long Measure

12 inches.....	1 foot	40 rods.....1 furlong
3 feet.....	1 yard	8 furlongs.....1 sta. mile
5 $\frac{1}{2}$ yards.....	1 rod	3 miles.....1 league

### Cloth Measure

2 $\frac{1}{4}$ inches.....	1 nail	4 quarters.....1 yard
4 nails.....	1 quarter	

### Square Measure

144 sq. inches.....	1 sq. ft.	40 sq. rods.....1 rood
9 sq. ft.....	1 sq. yard	4 roods.....1 acre
30 $\frac{1}{4}$ sq. yards.....	1 sq. rod	640 acres.....1 sq. mile

## Weights and Measures

### Surveyors Measure

7.92 inches.....	1 link
25 links.....	1 rod      4 rods.....
10 sq. chains or 160 sq. rods.....	1 acre
640 acres.....	1 sq. mile
36 sq. miles (6 miles sq.).....	1 township

### Cubic Measure

1,728 cubic in.....	1 cu. ft.	128 cu. ft.,...	1 cord (wood)
27 cubic ft.....	1 cu. yard	40 c. f.....	1 ton (shpg)
2150.42 cubic inches.....			1 standard bushel
231 cubic inches.....		1 U. S. standard gallon	
1 cubic ft.....		about $\frac{1}{4}$ of a bushel	

### Metric Equivalents—Linear Measure

1 centimeter.....	0.3937 in.	1 in.....	2.54 centimeters
1 decimeter.....	3.937 in.....		0.328 ft.
1 ft.....			3.048 decimeters
1 meter.....	39.37 in.		1.0936 yards
1 yd.....			0.9144 meter
1 dekameter.....	1.9884 rods	1 rd.....	0.5029 dekameter
1 kilometer.....	0.62137 m.	1 m.....	1.6093 kilometers

### Square Measure

1 sq. centimeter	0.1550 sq. in.	1 sq. in.	6.452 sq. centimeters
1 sq. decimeter	0.1076 sq. ft.	1 sq. ft.	9.2903 sq. decimeters
1 sq. meter.....	1.196 sq. yd.	1 sq. yd.....	0.8361 sq. m'r
1 are.....	3.954 sq. rods	1 sq. rd.....	0.2529 are
1 hectare.....	2.47 acres	1 acre.....	0.4047 hectare
1 sq. kilometer...	0.386 sq. m.	1 sq. m....	2.59 sq. kilometers

### Weights

1 gram.....	0.03527 ounce	1 ounce.....	28.35 grams
1 kilogram.....	2.2046 lbs.	1 lb.....	0.4536 kilogram
1 metric ton.....	1.1023 English tons	1 English ton.....	0.9072 metric ton

### Approximate Metric Equivalents

1 decimeter.....	4 in.	1 liter.....	1.06 qts. liquid
1 meter.....	1.1 yds.		0.9 qt. dry
1 kilometer.....	$\frac{5}{8}$ of a mile	1 hektoliter.....	2 $\frac{1}{2}$ bus.
1 hectare.....	2 $\frac{1}{2}$ acres	1 kilogram.....	2 $\frac{1}{2}$ lbs.
1 stere, or cu. meter		1 metric ton.....	2,200 lbs.
$\frac{1}{4}$ of a cord			



## Weights

1 cubic inch of Cast Iron.....	weighs.....	0.260 pounds
1 cubic inch of Wrought Iron.....	weighs.....	0.280 pounds
1 cubic inch of Water.....	weighs.....	0.036 pounds
1 U. S. Gallon.....	weighs.....	8.330 pounds
1 Imperial Gallon.....	weighs.....	10.000 pounds
1 U. S. Gallon.....	equals.....	231.000 cubic inches
1 Imperial Gallon.....	equals.....	277.274 cubic inches
1 cubic foot of Water.....	equals.....	7.480 U. S. gallons
1 pound of Steam.....	equals.....	27.222 cubic feet
1 pound of Air.....	equals.....	13.817 cubic feet

## General Data

1 Calorie.....	=	3.968 B. t. u.
1 B. t. u.....	=	0.252 Calorie
1 lb. per sq. in.....	=	703.08 kilogrammes per m <sup>2</sup>
1 Kilogramme per m <sup>2</sup> .....	=	.00142 lbs. per sq. in.
1 Calorie per m <sup>2</sup> .....	=	.3687 B. t. u. per sq. ft.
1 B. t. u. per sq. ft.....	=	2.712 calories per m <sup>2</sup>
1 Calorie per m <sup>2</sup> per degree difference Cent.....	} = {	.2048 B. t. u. per sq. ft.
per degree difference Fahr.....		per degree difference Fahr.
1 B. t. u. per sq. ft. per degree difference Fahr.....	} = {	4.882 Calories per m <sup>2</sup> per
degree difference Fahr.....		degree difference Cent.
1 B. t. u. per lb.....	=	.556 Calories per kilog.
1 Calorie per kilog.....	=	1.8 B. t. u. per lb.
1 Litre of Coke at 26.3 lbs. per cubic foot.....	=	.93 lbs.
1 lb. of Coke at 26.3 lbs. per cubic foot.....	=	1.076 litres.
Water expands in bulk from 40 degrees to 212 degrees....	=	One twenty-third.

A cubic inch of water evaporated under ordinary atmospheric pressure is converted into 1 cubic foot of steam (approximately).

## Melting Points of Different Metals

Aluminum.....	1400°	Iron (cast).....	2450°
Antimony.....	810°	Iron (wrought).....	2912°
Bismuth.....	476°	Lead.....	608°
Brass.....	1900°	Platinum.....	3080°
Bronze.....	1692°	Silver (pure).....	1873°
Copper.....	1996°	Steel.....	2500°
Glass.....	2377°	Tin.....	446°
Gold (pure).....	2590°	Zinc.....	680°

## To Find Specific Gravity of a Substance

W = weight of body in air: w = weight of body in water.

$$\text{Specific Gravity} = \frac{W}{W-w}$$

If the substance be lighter than the water, sink it by means of a heavier substance, and deduct the weight of the heaviest substance.

### Weight and Specific Gravity of Metals

Metals	Wt. per Cu. Ft., Lbs.	Wt. per Cu. In., Lbs.	Specific Gravity
Aluminum.....	166	.096	2.67
Antimony, cast.....	419	.242	6.72
Bismuth.....	613	.353	9.822
Brass, cast.....	524	.3	8.4
Bronze.....	534	.308	8.561
Copper, cast.....	537	.31	8.607
Copper, wire.....	555	.32	8.9
Gold, 24 carat.....	1208	.697	19.361
Gold, standard.....	1106	.638	17.724
Gun-metal.....	528	.304	8.459
Iron, cast.....	450	.26	7.21
Iron, wrought.....	485	.28	7.78
Lead, cast.....	708	.408	11.36
Lead, rolled.....	711	.41	11.41
Mercury.....	849	.489	13.596
Platinum.....	1344	.775	21.531
Platinum, sheet.....	1436	.828	23.
Silver, pure.....	654	.377	10.474
Silver, standard.....	644	.371	10.312
Steel.....	490	.284	7.85
Tin, cast.....	455	.262	7.291
Zinc.....	437	.252	7.

### Weight and Specific Gravity of Liquids

Water—The weight of fresh water is in practice usually assumed as 62½ lbs. per cubic foot. But 62¼ would be nearer the truth at ordinary temperatures, about 70°; or a lb. = 27.759 cubic inches.

	Specific Gravity	Wt. per Cu. In., Lbs.	Wt. per Gal., Lbs.
Water, distilled, 60° F.....	1.	.036	8.33
Water, sea.....	1.03	.037	8.55
Water, Dead Sea.....	1.24	.045	10.4
Acid, Acetic.....	1.062	.038	8.78
Acid, Nitric.....	1.217	.044	10.16
Acid, Sulphuric.....	1.841	.067	15.48
Acid, Muriatic.....	1.2	.043	9.93
Alcohol, pure.....	.792	.029	6.7
Alcohol, proof.....	.916	.033	7.62
Alcohol, of commerce.....	.833	.030	6.93
Cider.....	1.018	.036	8.4
Honey.....	1.45	.052	12.
Milk.....	1.032	.037	8.55
Molasses.....	1.426	.05	11.66
Oil, Linseed.....	.940	.034	7.85
Oil, Olive.....	.915	.033	7.62
Oil, Turpentine.....	.870	.031	7.16
Oil, Whale.....	.923	.033	7.65
Naphtha.....	.848	.031	7.
Petroleum.....	.878	.032	7.39
Tar.....	1.015	.036	8.4
Wines (average).....	.998	.036	8.3

Note: Above information quoted from standard authorities—not guaranteed.

## Rules Relative to the Circle

### To Find Circumference

Multiply diameter by 3.1416, or divide diameter by 0.3183.

### To Find Diameter

Multiply circumference by 0.3183, or divide circumference by 3.1416.

### To Find Radius

Multiply circumference by 0.15915, or divide circumference by 6.28318.

### To Find Side of an Inscribed Square

Multiply diameter by 0.7071, or multiply circumference by 0.2251, or divide circumference by 4.4428.

### To Find Side of an Equal Square

Multiply diameter by 0.8862, or divide diameter by 1.1284, or multiply circumference by 0.2821, or divide circumference by 3.545.

### Square

A side multiplied by 1.1442 equals diameter of its circumscribing circle.

A side multiplied by 4.443 equals circumference of its circumscribing circle.

A side multiplied by 1.128 equals diameter of an equal circle.

A side multiplied by 3.547 equals circumference of an equal circle.

Square inches multiplied by 1.273 equals circle inches of an equal circle.

### To Find the Area of a Circle

Multiply circumference by one-quarter of the diameter, or multiply the square of diameter by 0.7854, or multiply the square of circumference by 0.7958, or multiply the square of  $\frac{1}{2}$  diameter by 3.1416.

### To Find the Surface of a Sphere or Globe

Multiply the diameter by the circumference, or multiply the square of diameter by 3.1416, or multiply four times the square of radius by 3.1416.

### To Find the Weight of Brass and Copper Sheets, Rods and Bars

Ascertain the number of cubic inches in piece and multiply same by weight per cubic inch.

Brass 0.2972, Copper 0.3212, or multiply the length by the breadth (in feet) and product by weight in pounds per square foot.

## Mensuration

Area of a triangle equals base multiplied by  $\frac{1}{2}$  of altitude.

Area of a parallelogram equals base multiplied by altitude.

Area of trapezoid equals altitude multiplied by  $\frac{1}{2}$  the sum of parallel sides.

Area of trapezium—divide into two triangles and find area of the triangles.

Area of segment of circle equals area of sector of equal radius, area of triangle, when the segment is less, and plus area of triangle, when the segment is greater than the semi-circle.

Area of a circle ring equals diameters of the two circles multiplied by difference of diameter, and that product by .7854.

Area of an ellipse equals product of the two diameters multiplied by .7854.

Area of a parabola equals base multiplied by  $\frac{2}{3}$  of altitude.

Area of a regular polygon equals sum of its sides multiplied by perpendicular from its center to one of its sides divided by 2.

Surface of cylinder or prism equals area of both ends plus length, multiplied by circumference.

Contents of cylinder or prism equals area of end multiplied by length.

Surface of sphere equals diameter multiplied by circumference.

Contents of sphere equals diameter cubed multiplied by .5236.

Convex surface of segment of sphere equals height of segment multiplied by circumference of the sphere of which it is a part.

Contents of segment of sphere equals (heights plus three times the square or radius of base) multiplied by (height multiplied by .5236).

Surface of pyramid or cone equals circumference of base multiplied by  $\frac{1}{2}$  of the slant height plus area of the base.

Contents of pyramid or cone equals area of base multiplied by  $\frac{1}{3}$  of altitude.

Surface of frustrum of cone or pyramid equals sum of circumference at both ends multiplied by  $\frac{1}{2}$  slant height plus area of both ends.

Contents of frustrum of cone or pyramid equals: Multiply areas of two ends together and extract square root. Add to this root the two areas and multiply by  $\frac{1}{3}$  altitude.

Contents of a wedge equals area of base multiplied by  $\frac{1}{2}$  altitude.

Note: Above information quoted from standard authorities — not guaranteed.



# Code

## Correspondence

Aback.....	Answer by mail.
Abactor.....	Answer by telegraph.
Abacus.....	Referring to our letter of.....
Abaft.....	Referring to your letter of.....
Abandon.....	See our letter today giving full particulars.
Abase.....	Have received no reply to our letter of.....
Abash.....	Referring to our telegram of.....
Abate.....	Referring to your telegram of.....
Abbacy.....	Wire reply to ours of.....
Abbey.....	Letter referred to is not received. Send copy.
Abott.....	Order referred to not received. Send copy.
Abdicate.....	Telegram referred to not received. Send copy.
Abduce.....	Letter referred to not received. Wire substance.
Abduct.....	Letter received. Will have our prompt attention.
Aberrate.....	Disregard our letter of.....
Abject.....	Disregard our telegram of.....
Abroad.....	Our letter.....gives full particulars.
Abolish.....	Referring to telephone conversation today.
Abound.....	Referring to order.....
Abridge.....	Trace by wire shipment order.....

## Inquiries

Baldric.....	Can you ship at once?
Ballad.....	Can you ship in.....?
Ballast.....	When will you ship order?
Balsam.....	When can you ship?
Baluster.....	How soon can you begin and complete shipment?
Bamboo.....	How soon can you ship and at what price f. o. b. factory?
Banish.....	How soon can you ship and at what price f. o. b. here?
Bandit.....	How soon can you ship and at what price f. o. b.?
Banner.....	Have you in stock?
Bargain.....	Have you in stock: if not, how soon can you ship?
Bark.....	When will you ship car containing our order?
Baron.....	When and by what route did you ship our order?
Barren.....	Quote price by wire f. o. b. factory.
Barter.....	Quote price by wire delivered here.
Batch.....	Quote price by wire delivered.....
Beam.....	Quote price by mail f. o. b. factory.
Beckon.....	Quote price by mail delivered here.
Bedew.....	Quote price by mail delivered.....
Beech.....	What substitutions can you make?
Bellow.....	May I quote?
Benefit.....	May I quote.....if necessary to secure order?
Besmut.....	I am offered.
Beverage.....	May I accept?
Billet.....	Wire price and best delivery.
Blarney.....	Wire if you have all or what part of the following in stock.
Blast.....	Have you shipped; if not, when will you ship?
Bluster.....	Wire carload rate on radiation to.....
Bound.....	Wire less carload rate on radiators to.....
Bovine.....	Wire carload rate on boilers to.....
Brace.....	Wire less carload rate on boilers to.....
Branch.....	Wire at once routing shipment.
Brocade.....	Advise by mail at once routing shipment.....
Bulwark.....	Wire car number and date you shipped order.

## Replies

Cabin.....	Ship at once.
Cadet.....	Ship at once material your quotation of.....
Candid.....	Ship what you can at once, follow with balance as soon as possible.

Replies (Continued)

Canvas.....	Ship what you can at once, advise regarding balance.
Cape.....	Ship by express.
Captain.....	Ship by express prepaid.
Card.....	Ship by express collect.
Cedar.....	Ship by express C. O. D.
Censer.....	Ship by freight.
Chain.....	Ship by best route.
Charm.....	Ship parcel post.
Checker.....	Ship parcel post C. O. D.
Circle.....	Ship with draft and bill-lading attached.....
Circuit.....	Ship in first car to.....
Circus.....	Ship immediately our order number.....
Citadel.....	Add to order.....
Citron.....	Cancel order.....
Civic.....	Cancel.....on order.....
Clam.....	Duplicate our order.....
Claret.....	Suspend work on order.....
Clamor.....	Substitute.....on order for.....
Clay.....	Enter order if you can ship promptly from stock.
Clean.....	Enter order if you can ship within a week.
Clef.....	Enter order if you can ship within one to two weeks.
Click.....	Enter order if you can ship within three to four weeks.
Cliff.....	Enter order our telegram of.....
Climax.....	Enter order our letter of.....
Clinic.....	Enter order your quotation of.....
Clip.....	Delivery satisfactory, enter order.
Close.....	If you have not shipped hold for further instructions order
Club.....	Do not hold for carload but ship at once order.....
Cluster.....	Do not hold for other order but ship quickly.....
Cob.....	Best we can do is to ship about.....
Codex.....	Can ship from stock if advised immediately.
Cohere.....	Can ship in two to three days.
Coker.....	Can ship in three to four days.
Colander.....	Can ship in one week.
Collide.....	Can ship in one to two weeks.
Colony.....	Can ship in two to three weeks.
Combat.....	Can ship in three to four weeks.
Comely.....	Can ship from stock if you substitute.....
Comfit.....	Can ship your order.....except..... Shall we make such shipment?
Compact.....	Can ship within time named.
Command.....	Can furnish material your inquiry.....
Compass.....	Cannot furnish material your order.....
Compeer.....	Cannot furnish material your inquiry.....
Comrade.....	Cannot ship order.....within time named.
Concave.....	Cannot locate your order.....
Concoct.....	Expect to ship.....
Concur.....	Expect to ship in three to four days.
Condole.....	Expect to ship in one week.
Condor.....	Expect to ship in one to two weeks.
Confine.....	Expect to ship in two to three weeks.
Confound.....	Expect to ship in three to four weeks.
Confront.....	Last of this week.
Congea.....	First of next week.
Conger.....	Radiators all assembled cannot cancel.
Congrue.....	Material referred to was shipped.....
Conjoin.....	Shall we ship your expense.
Conjunct.....	Specify quantity each size.
Connate.....	Cannot modify our quotation.
Connive.....	Unable to quote on your inquiry for delivery required.
Conoid.....	We do not make.
Conquer.....	We do not make, will.....be satisfactory as substitution?
Conscribe.....	You may quote.
Console.....	You may quote for immediate shipment.

### Replies (Continued)

Consort.....	You may quote for immediate acceptance.
Conspire.....	You may quote for delivery stated.
Constrict.....	Cents per square foot f. o. b. Johnstown, full freight allowed to destination.
Copal.....	Cents per square foot f. o. b. Trenton, full freight allowed to destination.
Copper.....	Dollars f. o. b. Johnstown, full freight allowed to destination.
Copra.....	Dollars f. o. b. Trenton, full freight allowed to destination.
Copse.....	Dollars f. o. b. New Castle, full freight allowed to destination.
Corridor.....	Material loaded, wire instructions.
Cortex.....	Carload rate of freight to.....is.....per 100 lbs.
Counter.....	Less carload rate of freight to.....is.....per 100 lbs.
Coupon.....	Carload rate of freight to.....on radiators is.....per 100 lbs.
Covet.....	Less carload rate of freight to.....on radiators is....per 100 lbs.
Cravat.....	Carload rate of freight to.....on boilers is.....per 100 lbs.
Craven.....	Less carload rate of freight to.....on boilers is.....per 100 lbs.
Craw.....	Price quoted includes.
Cream.....	F. O. B. factory less actual rate of freight in carloads or less carloads to any railroad point of destination not to exceed 40c. per 100 lbs.
Crest.....	Will be in.....
Crevice.....	Will be here until.....
Crimson.....	2½ per cent.
Critic.....	5 per cent.
Cronet.....	7½ per cent.
Cruise.....	10 per cent.
Crumb.....	Send us sketch of special radiator.
Crusade.....	Letter with full particulars follows.
Crutch.....	Freight prepaid to.....
Crystal.....	Freight prepaid to destination.....
Cudgel.....	Estimate weight in pounds is.....
Cuddy.....	Make proposed shipment order.....without waiting for.....
Culture.....	Minimum carload weight is.....pounds.

### General Numbers

ab.....	1	ah.....	6
ac.....	2	ak.....	7
ad.....	3	al.....	8
af.....	4	am.....	9
ag.....	5	ar.....	0

By combining these syllables into words, any number may be formed:

Examples:

20.....	acar
341.....	adafab
1256.....	abacagah

These are for heights, order numbers or quantities.

### Inches

Ideal.....	¼	Ignore.....	⅞
Ides.....	¼	Illegal.....	1
Idion.....	⅜	Illicit.....	1¼
Idler.....	½	Illude.....	1½
Ignite.....	⅝	Income.....	2
Ignoble.....	¾		

### Table of Dates

To the word representing the date add the suffix representing the month, for example, for the 10th of January, Dearville; for the 5th of June, Darkwick.

# CODE

## Days

Dace.....1st	Deed.....12th	Dime.....23rd
Dais.....2nd	Deft.....13th	Dint.....24th
Dame.....3rd	Dell.....14th	Dire.....25th
Damp.....4th	Demi.....15th	Dirk.....26th
Dark.....5th	Dent.....16th	Disc.....27th
Dash.....6th	Desk.....17th	Dock.....28th
Date.....7th	Dial.....18th	Doge.....29th
Daub.....8th	Dice.....19th	Dome.....30th
Dean.....9th	Diet.....20th	Dray.....31st
Dear.....10th	Digit.....21st	
Debt.....11th	Dike.....22nd	

## Months

Ville.....January	Dale.....July
Ford.....February	Field.....August
Side.....March	Shire.....September
Cliff.....April	Burg.....October
Word.....May	Ton.....November
Wick.....June	Dell.....December

## Radiators

Rabbit.....One Column Premo Water.
Rabble.....One Column Premo Steam.
Rabid.....Two Column Premo Water.
Race.....Two Column Premo Steam.
Racial.....Three Column Premo Water.
Rack.....Three Column Premo Steam.
Racket.....Four Column Premo Water.
Racoon.....Four Column Premo Steam.
Radical.....Five Column Premo Water.
Radish.....Five Column Premo Steam.
Rare.....14½" (4 ft.) Novus Water.
Ratify.....14½" (4 ft.) Novus Steam.
Ratio.....20" (5 ft.) Novus Water.
Rational.....20" (5 ft.) Novus Steam.
Rattan.....28" (7 ft.) Novus Water.
Rattle.....28" (7 ft.) Novus Steam.
Rave.....36" (9 ft.) Novus Water.
Ray.....36" (9 ft.) Novus Steam.
Ream.....25⅝" (10 ft.) Somerset Indirect.
Rebuke.....25⅝" (10 ft.) Bedford Indirect.
Recede.....31⅝" (12½ ft.) Somerset Indirect.
Recess.....31⅝" (12½ ft.) Bedford Indirect.
Recite.....37⅝" (15 ft.) Somerset Indirect.
Reckon.....37⅝" (15 ft.) Bedford Indirect.
Rector.....No. 1-22 Novus Plate Warmer.
Redout.....No. 2-22 Novus Plate Warmer.
Redraw.....No. 3-22 Novus Plate Warmer.
Redress.....No. 1-30 Novus Plate Warmer.
Reef.....No. 2-30 Novus Plate Warmer.
Reel.....No. 3-30 Novus Plate Warmer.
Refine.....No. 1-38 Novus Plate Warmer.
Reform.....No. 2-38 Novus Plate Warmer.
Refuge.....No. 3-38 Novus Plate Warmer.
Regain.....Premo Circular for Water.
Regal.....Premo Circular for Steam.
Region.....Premo Corner for Water.
Rejoice.....Premo Corner for Steam.
Relent.....Premo Curved for Water.
Relic.....Premo Curved for Steam.
Rigid.....Semi-Indirect for Water.
Riot.....Semi-Indirect for Steam.



### Radiator Leg Sections

Label.....	Feed leg section, one pipe steam.
Leach.....	Feed leg section, two pipe steam.
Lobby.....	Feed leg section, hot water.
Locket.....	Return leg section, one pipe steam.
Lodge.....	Return leg section, two pipe steam.
Lottery.....	Return leg section, water.
Loyal.....	Middle leg section, steam.
Lucid.....	Middle leg section, water.
Lurch.....	Intermediate section, steam.
Luster.....	Intermediate section, water.

### Tappings

Tally.....	One pipe steam regular list.
Talon.....	Two pipe steam regular list.
Tamany.....	Regular for water.
Tandem.....	Tappings bottom opposite ends.
Tardy.....	Tappings top and bottom same end.
Tarpon.....	Tappings top and bottom opposite ends.
Tartan.....	Tappings top and bottom both ends.
Tartar.....	Tappings top and bottom one end, bottom opposite end.
Tattoo.....	Tapping double hub one end.
Taunt.....	$\frac{3}{4}$ inch one pipe.
Tedius.....	$\frac{3}{4} \times \frac{3}{4}$ inch.
Telpher.....	1 inch one pipe.
Tempest.....	1 x $\frac{3}{4}$ inch.
Tenant.....	1 x 1 inch.
Tenor.....	1 $\frac{1}{4}$ inches one pipe.
Termite.....	1 $\frac{1}{4} \times \frac{3}{4}$ inch.
Terrace.....	1 $\frac{1}{4} \times 1$ inch.
Ticket.....	1 $\frac{1}{4} \times 1 \frac{1}{4}$ inches.
Tide.....	1 $\frac{1}{2}$ inches one pipe.
Tiger.....	1 $\frac{1}{2} \times 1$ inch.
Tinder.....	1 $\frac{1}{2} \times 1 \frac{1}{4}$ inches.
Tingle.....	1 $\frac{1}{2} \times 1 \frac{1}{2}$ inches.
Tirade.....	2 inches one pipe.
Tokay.....	2 x 1 $\frac{1}{2}$ inches.
Tome.....	2 x 1 $\frac{1}{4}$ inches.
Tonic.....	2 x 1 inch.
Topaz.....	2 x 2 inches.
Tudor.....	To have high legs so that distance from floor to center of tapping is.....inches.

### Radiators, Miscellaneous

Madras.....	One Column Concealed Brackets.
Magnate.....	Two Column Concealed Brackets.
Majesty.....	Three Column Concealed Brackets.
Major.....	Novus Pedestal Bracket A-to center tapping 4 in.
Malady.....	Novus Pedestal Bracket A-to center tapping 6 in.
Mallard.....	Novus Pedestal Bracket A-to center tapping 8 in.
Maltese.....	Novus Pedestal Bracket B-to center tapping 4 in.
Mandate.....	Novus Pedestal Bracket B-to center tapping 6 in.
Mane.....	Novus Pedestal Bracket B-to center tapping 8 in.
Manger.....	Novus Pedestal Bracket C-to center tapping 8 in.
Manicure.....	Novus Pedestal Bracket D-to center tapping 8 in.
Manikin.....	Novus Wall Bracket E.
Mansion.....	Novus Wall Bracket F.
Mantle.....	Novus Wall Bracket G.
Maple.....	Novus Wall Bracket H.
Marine.....	Novus Wall Bracket I.
Maritime.....	Novus Wall Bracket J.
Maroon.....	Novus Wall Bracket K.
Mars.....	Novus Wall Bracket L.

### Radiators, Miscellaneous (Continued)

Martial.....	5 Section Direct-Indirect Base.
Meadow.....	6 Section Direct-Indirect Base.
Meager.....	7 Section Direct-Indirect Base.
Meal.....	8 Section Direct-Indirect Base.
Meander.....	9 Section Direct-Indirect Base.
Medal.....	10 Section Direct-Indirect Base.
Medical.....	11 Section Direct-Indirect Base.
Meek.....	12 Section Direct-Indirect Base.
Melody.....	13 Section Direct-Indirect Base.
Memory.....	14 Section Direct-Indirect Base.
Menace.....	5½ x 17 Improved Cold Air Box.
Menthol.....	8 x 25 Improved Cold Air Box.
Meridian.....	Plug 2 inches.
Mermaid.....	Plug 1½ inches.
Minstrel.....	Plug ¾ inch.
Miracle.....	Bushing 2 x 1½ inches.
Miser.....	Bushing 2 x 1¼ inches.
Missile.....	Bushing 2 x 1 inch.
Modest.....	Bushing 2 x ¾ inch.
Modulate.....	Bushing 2 x ½ inch.
Molar.....	Bushing 1½ x 1¼ inches.
Monger.....	Bushing 1½ x 1 inch.
Mongrel.....	Bushing 1½ x ¾ inch.
Mundane.....	Bushing 1½ x ½ inch.
Myriad.....	Radiator Shields.....sections.

### Radiator Specialties

Saber.....	Air Valves, Novus Automatic.
Sabot.....	Air Valves, Solus Perfect Automatic.
Sacrist.....	Air Valves, Solus Perfect Automatic Lock Shield.
Saddle.....	Air Valves, Solus Perfect Automatic Vacuum.
Sailor.....	Air Valves, Key.
Salify.....	Air Valves, Wood Wheel.
Saliva.....	Air Valves, Hoffman No. 1.
Sallow.....	Air Valves, Hoffman No. 2.
Saltus.....	Air Valves, Hoffman No. 3.
Salute.....	Air Valves, Hoffman No. 4.
Salver.....	Air Valves, Hoffman No. 5.
Sandal.....	Air Valves, Hoffman No. 6.
Sanguine.....	Air Valves, Hoffman No. 7.
Sanify.....	Air Valves, Hoffman No. 8.
Sanity.....	Air Valves, Hoffman No. 9.
Sarcoma.....	Brushes, Flue.
Sardine.....	Bronze, Gold X Brilliant.....(.....pounds).
Sateen.....	Bronze, Gold XX Brilliant.....(.....pounds).
Satire.....	Bronze, Aluminum.....(.....pounds).
Savor.....	Bronzing Liquid, 1 gal. cans.....(No.....).
Saxon.....	Bronzing Liquid, ½ gal. cans.....(No.....).
Secret.....	Black Asphaltum, gallon cans.....(No.....).
Sedate.....	Cement, Asbestos.....(.....pounds).
Salvage.....	Empire Steam Trap (No.....)
Sentry.....	Floor and Ceiling Plates, Steel N. P.
Sepsis.....	Gauges, Altitude.
Septan.....	Gauges, Steam.
Sequel.....	Minneapolis Heat Regulator, Type Motor.....(No.....)
Serge.....	Regulator, Novus Damper.
Signor.....	Tanks, Expansion Galvanized Steel (.....gallons).
Selica.....	Tanks, Expansion (.....gallons with trimmings).
Slope.....	Tank Brackets.
Sloven.....	Thermometers, Straight.
Slumber.....	Thermometers, Angle.
Soda.....	Union Elbows, N. P.
Sodality.....	Valves, Hot Water, Quick Opening.

### Radiator Specialties (Continued)

Sodden.....	Valves, Hot Water, Straightway.
Sparrow.....	Valves, Steam, Angle Type Jenkins Disc.
Spinster.....	Valves, Gate, Wood Wheel with Union.
Spirant.....	Valves, Gate, Wood Wheel without Union.
Spin.....	Valves, Globe without Union.
Spire.....	Valves, Corner, Right Hand.
Spite.....	Valves, Corner, Left Hand.
Splash.....	Valves, Regulating Gas.
Spoken.....	Valves, Regulating, Street Steam.
Sponge.....	Valves, Packless, Graduate Type (with shells).
Spook.....	Valves, Packless, Graduate Type (without shells).
Spoon.....	Valves, Pop Safety.
Sport.....	Valves, Water Relief.
Spotter.....	Waterback, Novus.
Sprain.....	Wrenches, Novus Spud.
Spray.....	Wrenches, Premo (Size.....).

### Novus Upright

#### Steam

Nabob.....	30-S
Nacarar.....	31-S
Nacelle.....	32-S
Nacre.....	40-S
Nacrite.....	41-S
Nadir.....	42-S
Nag.....	50-S
Naggy.....	51-S
Nahoor.....	52-S
Nankeen.....	60-S
Nap.....	61-S
Napery.....	62-S

#### Water

Napkin.....	30-W
Narcissus.....	31-W
Narcotic.....	32-W
Nard.....	40-W
Narrate.....	41-W
Narrow.....	42-W
Nasal.....	50-W
Nascent.....	51-W
Nastily.....	52-W
Natal.....	60-W
Nation.....	61-W
Native.....	62-W

### Nico Round

#### Steam

Natty.....	S-17-2
Natural.....	S-17-3
Nature.....	S-17-4
Naught.....	S-19-2
Nausea.....	S-19-3
Nautch.....	S-19-4
Naval.....	S-22-2
Navy.....	S-22-3
Neap.....	S-22-4
Near.....	S-25-2
Neat.....	S-25-3
Nebula.....	S-25-4
Neck.....	2820
Necklace.....	2830
Nectar.....	2840

#### Water

Need.....	W-17-2
Needle.....	W-17-3
Needy.....	W-17-4
Negation.....	W-19-2
Neglect.....	W-19-3
Negro.....	W-19-4
Negus.....	W-22-2
Neighbor.....	W-22-3
Neither.....	W-22-4
Neon.....	W-25-2
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Novus Sectional

Steam		Water	
Net!.....	20-5-S	Noise.....	5-20-W
Nether.....	20-6-S	Nomad.....	6-20-W
Neutral.....	20-7-S	Nominal.....	7-20-W
Neuro.....	25-5-S	Nones.....	5-25-W
Neuter.....	25-6-S	Noodle.....	6-25-W
Never.....	25-7-S	Nook.....	7-25-W
New.....	25-8-S	Noon.....	8-25-W
Next.....	31-6-S	Norse.....	6-31-W
Nibble.....	31-7-S	Nose.....	7-31-W
Nice.....	31-8-S	Nostril.....	8-31-W
Nick.....	31-9-S	Notary.....	9-31-W
Nidus.....	36-6-S	Note.....	6-36-W
Niece.....	36-7-S	Notion.....	7-36-W
Night.....	36-8-S	Nought.....	8-36-W
Nipper.....	36-9-S	Noun.....	9-36-W
Nitric.....	36-10-S	Novel.....	10-36-W
Nobby.....	48- 6-S	Nozzle.....	6-48-W
Noble.....	48- 7-S	Nude.....	7-48-W
Nodal.....	48- 8-S	Nugget.....	8-48-W
Nodose.....	48- 9-S	Nuncio.....	9-48-W
Nodular.....	48-10-S	Nurse.....	10-48-W
Noggin.....	48-11-S	Nymph.....	11-48-W

Radium Gas Boilers

Steam		Water	
Gable.....	4-S	Garner.....	41-W
Gadfly.....	5-S	Garnish.....	51-W
Gaffer.....	6-S	Garret.....	61-W
Gagger.....	7-S	Garter.....	71-W
Gaiety.....	8-S	Gash.....	4-W
Gale.....	9-S	Gasket.....	5-W
Gallant.....	10-S	Gasp.....	6-W
Galley.....	11-S	Gassy.....	7-W
Gallon.....	12-S	Gate.....	8-W
Gallop.....	13-S	Gandy.....	9-W
Galosh.....	14-S	Gauge.....	10-W
Gambit.....	15-S	Gaunt.....	11-W
Gamble.....	16-S	Gavel.....	12-W
Game.....	17-S	Gear.....	13-W
Gamin.....	18-S	Geld.....	14-W
Gander.....	19-S	Gelose.....	15-W
Gangue.....	20-S	Genet.....	16-W
		Genius.....	17-W
		Genteel.....	18-W
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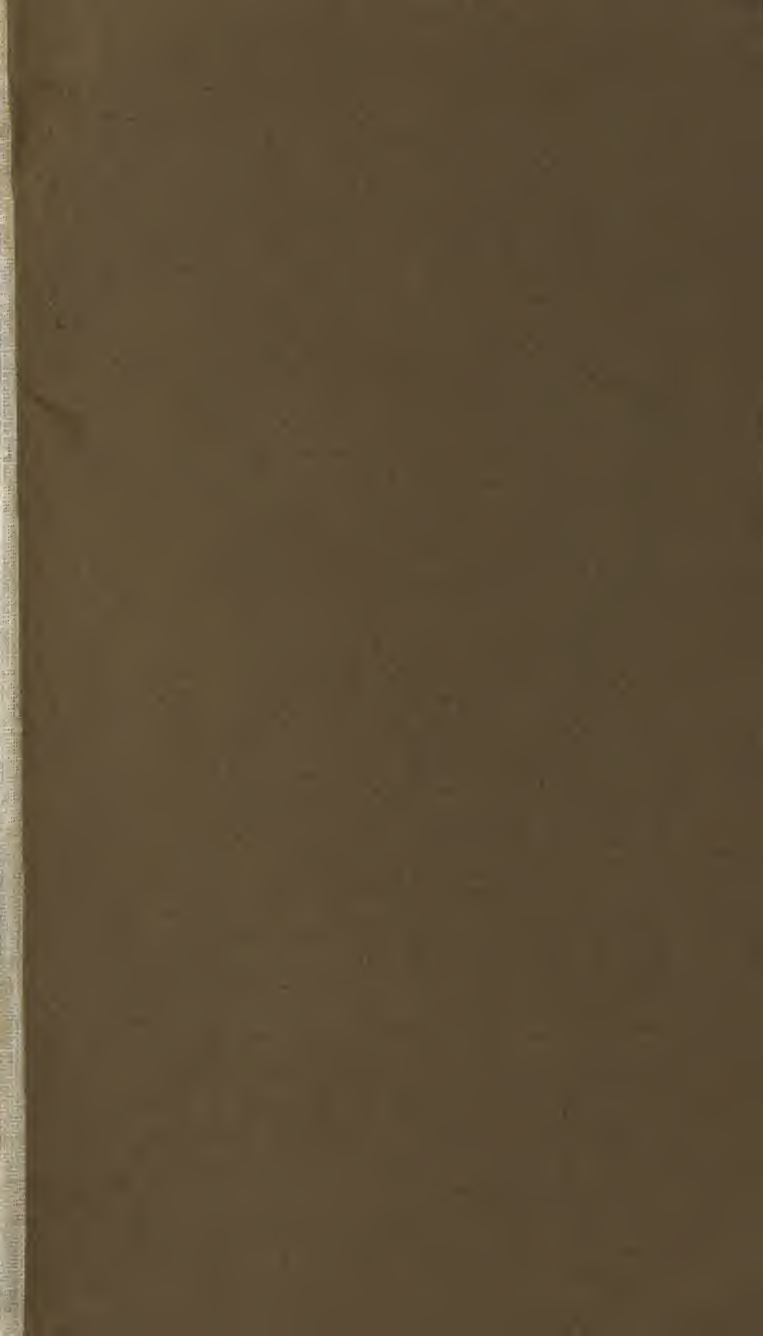
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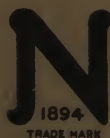
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